ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

JANUARY 1956

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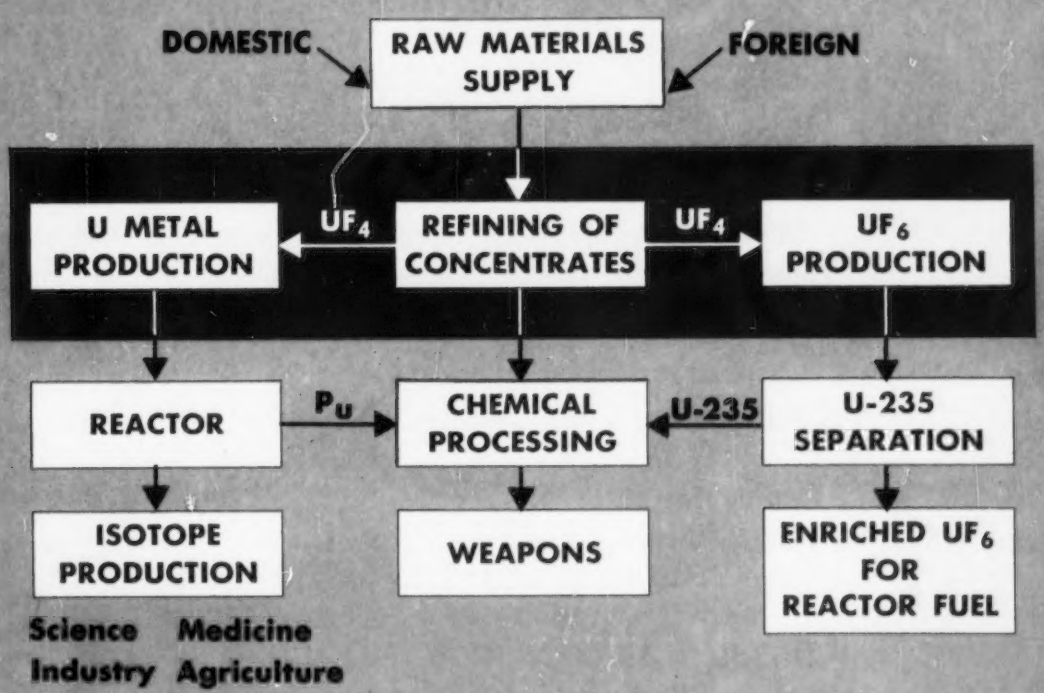
E&MJ's International Mining Series . . .

Türkiyede Maden İşleri (Mining in Turkey) p 88

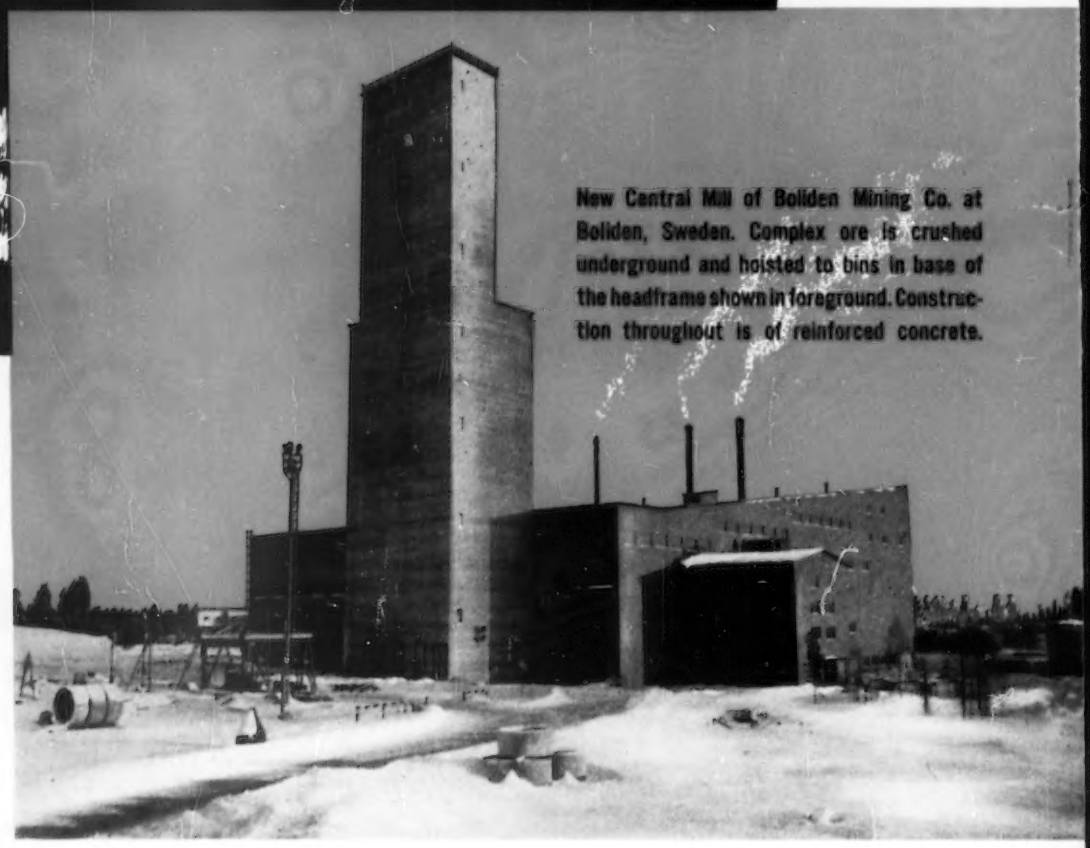
Now AEC is inviting private enterprise to enter this once-shrouded area of feed material production

Production of Fissionable Materials From Uranium



For what this new opportunity means to you — See p 78

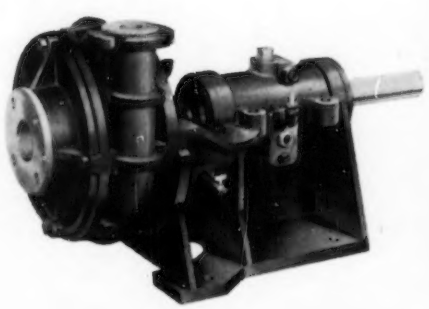
Swedish efficiency calls for HYDROSEAL PUMPS



New Central Mill of Boliden Mining Co. at Boliden, Sweden. Complex ore is crushed underground and hoisted to bins in base of the headframe shown in foreground. Construction throughout is of reinforced concrete.

Nearly forty Hydroseal Slurry pumps are installed at this unique mine near the Arctic Circle, where complex copper, lead, zinc and pyrite ore is milled at the annual rate of 600,000 metric tons. Not surprising, since many other Hydroseals have long been distinguishing themselves at other Boliden Company properties.

Why do Hydroseals pump so well, while netting startling savings in maintenance and power costs? Write us today for Hydroseal Catalog No. 953.



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315 *cfm*
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90th YEAR OF PUBLICATION

VOL. 157 NO. 1

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LETTERS

Where's the Challenge?

Your article "Engineering in the Outfield" (*E&MJ* November 1955, p. 67) certainly does not fit in with my viewpoint concerning the mining industry. Although my interest in this industry is still avid, my first experience after college graduation was disheartening.

I received my B.S. in metallurgical engineering in June 1953 and majored in mineral dressing. During my undergraduate years, I worked in the mines out West and in the Michigan copper country summers while in school. Although I graduated with honors, I had very few job offers to consider and finally accepted employment with a large iron ore producer in northern Minnesota as a beneficiation engineer, despite this company's poor employment record.

When I severed employment with this company in February 1955, I was the third mining metallurgist to have left their employ in the last two years, and the fifth to have left in the last 3½ years!

Despite contact with my school placement service and the various mining trade publications, I did not receive any offers that would indicate that the mining industry is "breaking down doors" in an attempt to interest or retain experienced or qualified personnel. I thus accepted employment with a large electronics concern in Minneapolis as a chemical process methods engineer and now as a tool engineer. I now have a chance to use my engineering education, have an opportunity to rise into a management level if I can prove qualified, and am making quite a considerable wage in comparison to my former job.

In my former job, I worked for inept management, had no chance for position advance, could not follow-up my work efforts, and encountered the worst type of supervisory-employee relations that could be imagined. Wage increases were practically non-existent.

Contacts that I have made with other people associated with the mining industry indicate that many of these above conditions exist elsewhere although to a much lesser degree than I encountered.

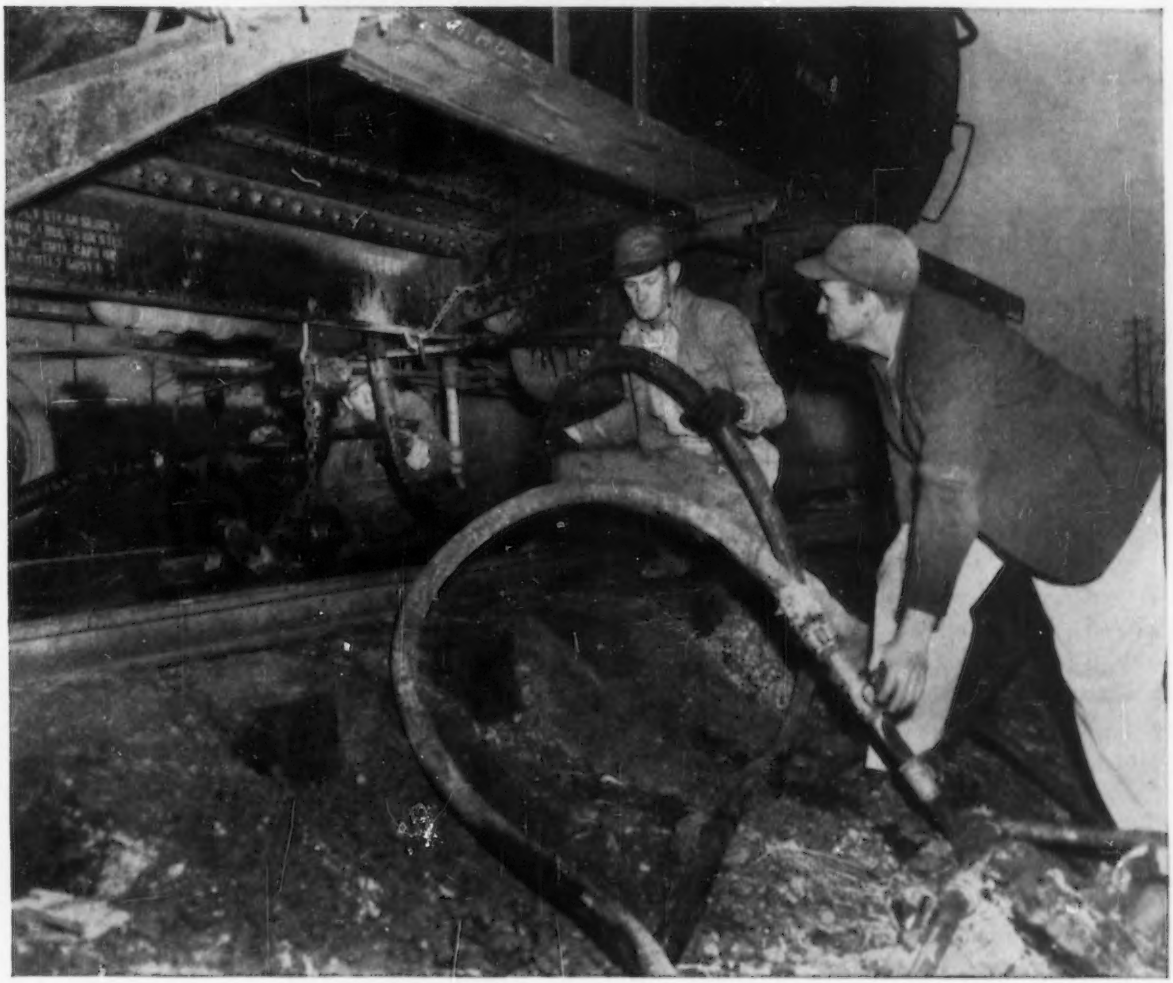
Where then is this great interest by the mining industry which challenges the engineer or that opens avenues to management? I therefore accept your article with a very large grain of salt.

Name Withheld
Minnesota

• As for the challenge—we can think of few that compare with the problems of extracting more and more metal from lower and lower grade, more complex, harder-to-find ores. This will take talent and ingenuity. We feel that the industry must correct many of its present practices, particularly in regard to personnel development, if it is going to have the talent available on all levels from first-line supervisor through staff engineers, to top management.—Ed.

Continued on p 110

RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER



Hose used to be more dangerous than snakes

A typical example of B. F. Goodrich improvement in rubber

THOSE men are inches away from a high explosive. Heating thick, gooey asphalt to get it out of a tank car takes super-heated steam under terrific pressure, carried into the car through hose.

Heat used to weaken steam hose. Sometimes it burst at the weakest spot, with explosive force, spraying scalding steam in all directions. It was dangerous to workmen and a constant expense.

B. F. Goodrich men believed a hose could be made completely *burstproof*. They designed one with layers of fine braided steel wire, then layers of a new kind of heat-resisting rubber, inside, outside and between the braids. Not one length of this hose has ever been known to burst. Even if a hose wears out after years of service, steam can leak out but it cannot explode. Workmen are as safe as they are at home.

The B. F. Goodrich hose in the picture had been in use for 2½ years when the picture was taken—far longer than any steam hose used before by this construction company—and showed no sign of wearing out. It not only stands heat better but wears better. Its rubber cover resists abrasion better than steel. This B. F. Goodrich hose is 30 per cent lighter than steam hose used to be, more flexible, easier to handle.

Call your B. F. Goodrich distributor for more information about steam hose or other hose, belting or other B. F. Goodrich rubber products. *The B. F. Goodrich Co., Department M-533, Akron 18, Ohio.*

B.F.Goodrich
INDUSTRIAL PRODUCTS DIVISION

How Crater keeps wire rope strong longer

One user (name on request) reports on his experience with *Texaco Crater* for the protection of wire rope:

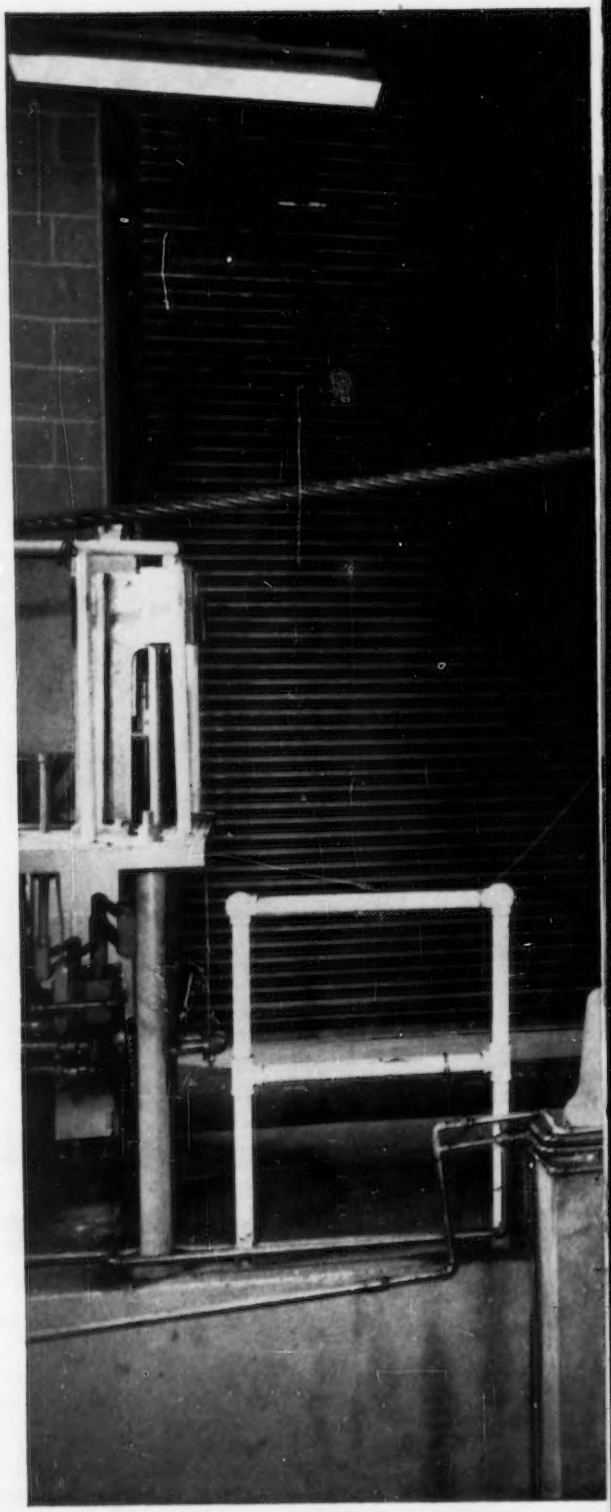
> **"After some two years' service . . . we sent a sample of the rope to the manufacturer for testing. The report on the test showed the rope to be perfectly lubricated and to have more tensile strength than guaranteed when sold to us."**

Texaco Crater keeps rope strong longer because it *penetrates,* gives all-around protection to strands and core. It coats each metal strand with a sturdy, clinging film that fights off wear and rust. It surrounds and protects the rope core, preserving its strength and life.

Many operators like the extra convenience of *Texaco Crater X Fluid*—which *goes* on as a liquid and *stays* on just like the regular *Crater.*

For mine car wheels, use *Texaco Olympian Grease.* It assures easier starts even in winter weather . . . gives long-lasting protection to all types of bearings . . . assures lower maintenance costs.

Let a Texaco Lubrication Engineer help you increase efficiency and reduce costs throughout your mine. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.



For over 20 years, more copper ore in the U. S. has been mined with Texaco-lubricated equipment than with any other

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on TV Saturday nights.
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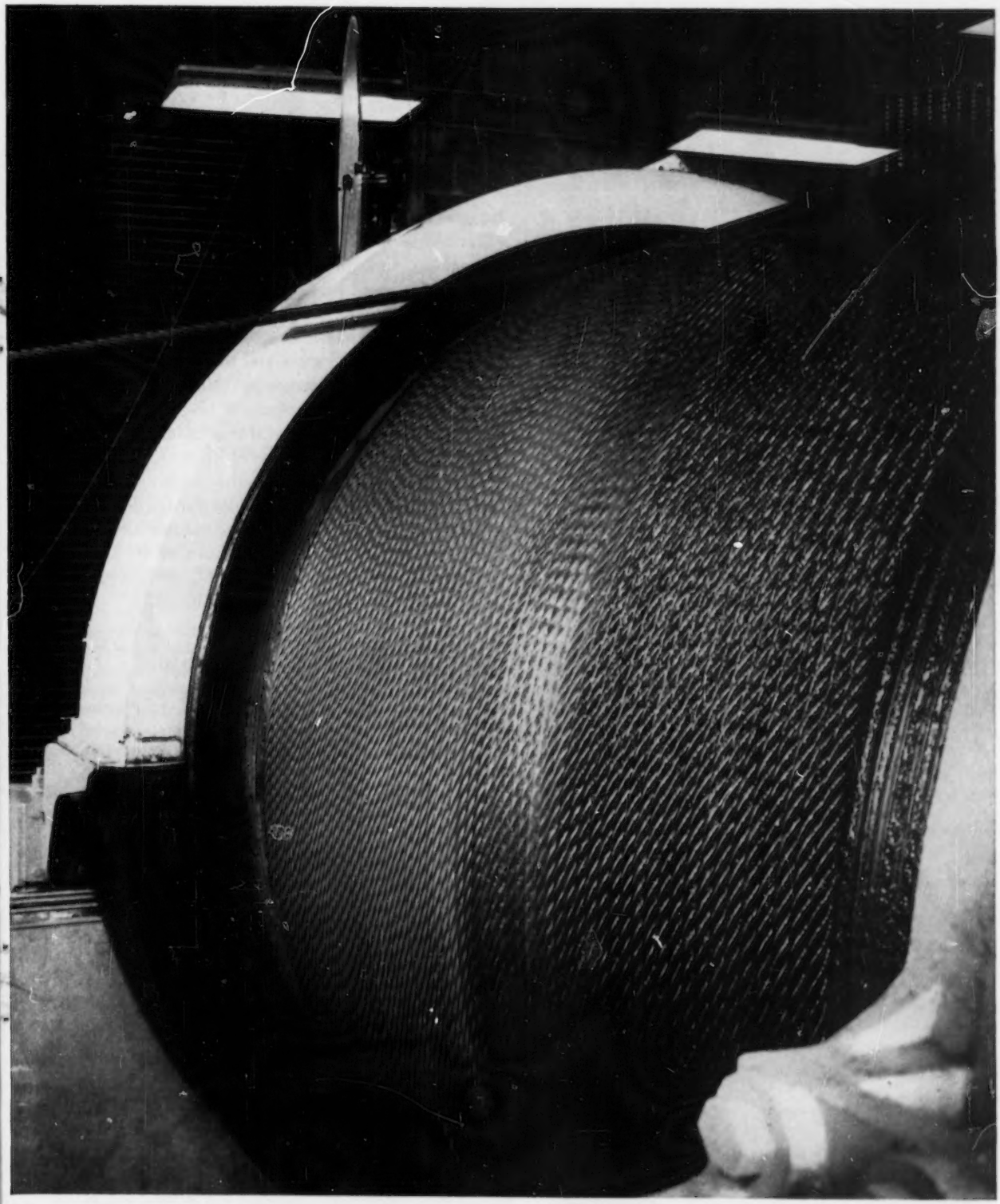

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FOR THE MINING INDUSTRY

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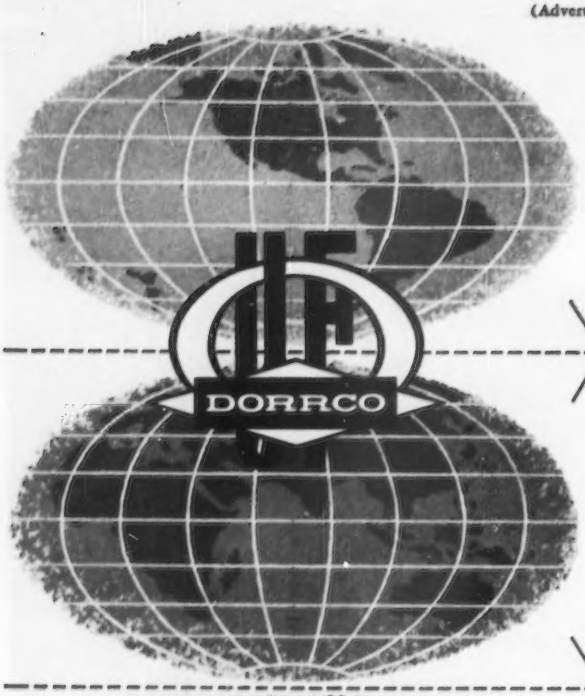


1955 has been a year of change, consolidation and progress in both a corporate and a technical sense for Dorr-Oliver. Just a year ago we were deeply involved in the complexities of merger and, as we near the end of this first year of combined operations, a review has more than usual significance.

Perhaps most notable has been the remarkable integration of our combined staff and its growing effectiveness in every area of operation. With this integration came important organizational change — the creation of new groups to handle technical problems more effectively and to explore new opportunities. With it also has come the strengthening of sales staff in some areas and the opening of new offices in others, designed to provide better service to our clients and customers.

Of the utmost importance in this rapidly developing picture is the welcoming of Dorr-Oliver-Long Limited as a full member of the worldwide D-O family. The natural result of a close and friendly relationship dating back to 1911, the consolidation of our Canadian operations with those of E. Long Limited of Orillia on January 1, 1956, will unquestionably strengthen our overall operations.

PULP AND PAPER — In 1955, field testing and subsequent commercial acceptance of the Webwelder for splicing corrugating medium and other heavy grades of paper was among our most significant projects. Contributing heavily to our volume of business were new or expanded Recausticizing Systems in the Pacific Northwest, Southeast, Canada, India, Sweden, Finland, Mexico and Chile. Next year the Horizontal Filter, already used for washing cotton linters, will be applied to pulp washing in a Southern mill.

INDUSTRIAL WASTES — Also in the pulp and paper industry, the largest biological kraft mill waste treatment plant in the world went into operation at West Virginia Pulp and Paper Company's Covington, Virginia, mill. And on the West Coast the most comprehensive treatment plant ever designed is now on stream handling wastes from an oil refinery. Both are D-O equipped. Orders were placed for waste treatment units to serve a midwest cannery and a large Eastern photographic equipment manufacturer.

PETROLEUM — The newly introduced D-Sander has proved to be extremely successful in removing sand from rotary drilling mud and has been widely utilized in the Gulf Coast oil fields. Fabrication of the longest petroleum filters ever constructed — six 10′ x 22′3″ Olivers for dewaxing — was completed at our Hazleton shops. Research and development continued on a new and unusual type of hydrocarbon purification unit, the applications of which appear almost boundless in the petroleum industry.

URANIUM — During the year a large D-O equipped Canadian uranium mill went into operation and orders were received for processing equipment to be used at six other United States and Canadian mills now under

construction or being expanded. Facilities at our Westport laboratories have been enlarged to handle all types of uranium extraction work and to process small quantities of material from ore through "yellow cake". In a closely related project — the production of rare earths — D-O equipment will be widely utilized in a plant under construction.

SUGAR — As a result of three years of development we have introduced the RapiDorr Cane Juice Clarifier designed with 30% less volume than conventional units. A number of these machines will be in operation in the coming 1956 campaigns. Our associates in Italy have sold two Continuous Carbonation Systems for beet sugar processing on the Italian peninsula and mills in India will clarify cane juice in units manufactured by D-O GmbH in Wiesbaden.

SANITATION — On the new Ohio Turnpike, wastes from eight service areas will be treated in D-O equipped plants. On a much larger scale, London, England will utilize sixteen Dorr Digesters in the expansion of their treatment facilities and in India two new sewage plants will be completely D-O equipped. At Milwaukee, Wisconsin, four sewage sludge filters will replace the original Olivers installed some 33 years ago and next year at Baltimore, Maryland the largest sanitary filters ever constructed — two 14′ x 18′ units — will go into operation.

The Densludge Process of prethickening sludge is now operating at two full-scale Biofiltration plants in the Southwest with general improvement in overall plant performance an unexpected result of its use. Tests have been virtually completed on a new Degritting Clarifier to be placed on the market in the near future. The Refuse Treator, which was developed in Holland and which may soon become an integral part of the domestic D-O line, gives the sanitary engineer another tool for the accomplishment of his ultimate goal.

RESEARCH AND DEVELOPMENT — Fundamental research has continued on the unit operations basic to D-O equipment. While such work is necessarily of a long range nature, increased fundamental knowledge has already led to marked advances in the field of clarification.

In addition to improvement of basic units, the company is constantly investigating new lines which can be profitably integrated with our other business. Current projects include an investigation to determine the manner in which D-O can make further contributions to the Atomic Energy Program and development of an ingenious Dutch device for fine screening.

COPPER — Half a world apart — in Israel and Arizona — two D-O designed copper ore dressing plants, one a full-scale operation and the other a pilot plant, are now under construction. In the United States, three large concentrators in the Southwest ordered equipment for plant expansions and in the Belgian Congo the first FluoSolids System to roast copper concentrates prior to electrolytic recovery went into operation.

FERTILIZER — Missouri Farmers Association's new plant, proving ground for the Diammonium Phosphate Process, attained design capacity in record time at Joplin, Missouri. Utilization of this new process makes commercial production of unusually high analysis fertilizer from concentrated phosphoric acid possible for the first time. In Japan, two more D-O designed fertilizer plants went into operation and a third was under construction in Norway.

WATER TREATMENT — In the field of water purification, Caracas, Venezuela and Kansas City, Missouri have duplicated orders of previous years for plant expansions and new facilities now under construction in both India and Turkey will employ extensive D-O equipment. First installations of the PeriFilter System, introduced two years ago, have shown marked economies of construction and unusual adaptability to small plants.

STARCH — Following the example of current practice in the Netherlands where the DorrClone was developed, five starch processing companies in other parts of the world ordered DorrClone Systems for their operations. Starch Washing Systems — each the first of its type in the various countries — will be installed in Brazil, Canada, Scotland and the United States. A fifth producer will use TM DorrClones to recover solids from starch washing filtrate in the U. S.

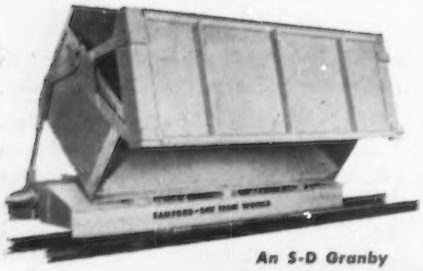
FLUOSOLIDS — Most significant achievement in the field of fluidization was the successful commercial demonstration of the first FluoSolids Coal Dryer. Equally adaptable to the drying of either metallurgical or steam coal, this unit will handle material as coarse as 1½″ with ease. During the year two other "firsts" were recorded — the first FluoSolids System went into operation in the Philippines and the first purchased for use in Germany. Repeat orders were received from companies in South Africa, Canada, Italy and Japan, and in the U. S. a large copper producer ordered its fourth complete System and seventh individual Reactor.

CHEMICAL — Expansion plans for alumina processing facilities in Jamaica and Germany, a potash countercurrent decantation system in New Mexico, and new brine purification and pigment plants in the U. S. all incorporated substantial amounts of Dorr-Oliver equipment in their flowsheets.

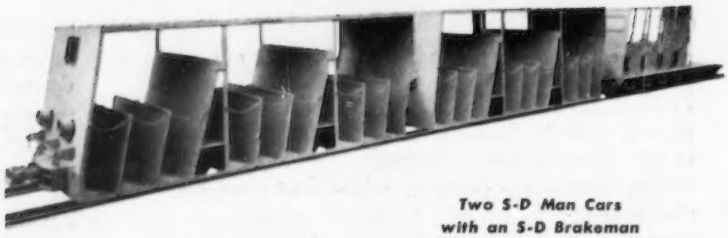
Any pride we may feel in the events and accomplishments of the year is shadowed by the sudden passing of one of our Founder-Chairmen, Edwin Letts Oliver, late in the summer just past. His mechanical genius, strength and human warmth will be deeply missed by the engineering fraternity of the world. To Dorr-Oliver, and to those of us who knew him well, his loss is irreparable.

For the future, our resources are considerable. The initial enthusiasm and resourcefulness of our staff, the promise of new developments and the strength and solidarity of our Associates in Canada and abroad — all point to a steadily increasing ability to serve and an eventful year ahead.

Stamford, Conn., U.S.A.



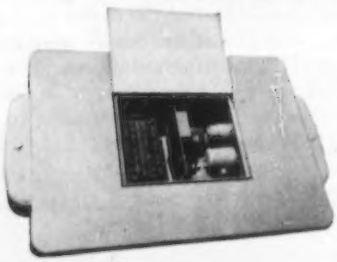
An S-D Granby

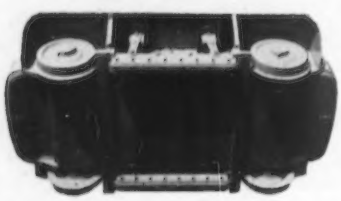


Two S-D Man Cars
with an S-D Brakeman

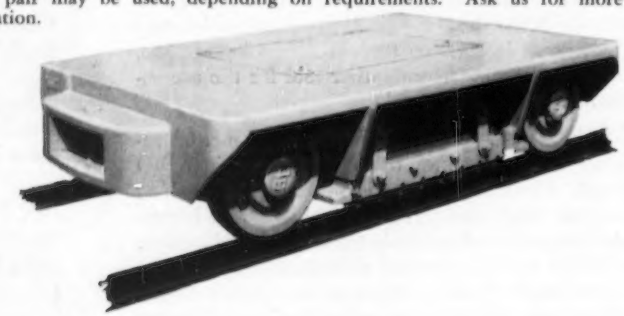
Sanford-Day ... Super

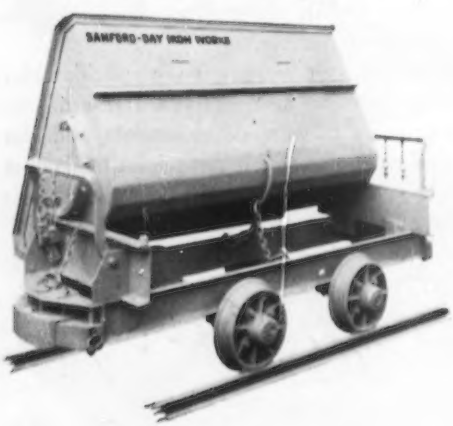
Now you can eliminate skids and additional locomotives for braking trips downgrade!



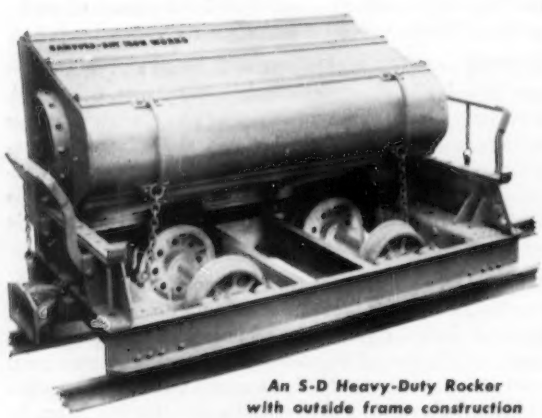


YOU NEED NO LONGER resort to skids or costly locomotives for extra braking power. We have developed a special car for braking that incorporates electrically operated magnetic brake shoes. Several are already on the job in metal mines. The S-D Brakeman Car is built to meet your particular requirements. It may be used between locomotives . . . between locomotive and cars . . . between cars or at end of a trip to prevent runaways due to coupler failures, etc. Controls can be provided at locomotive operator's fingertips. Top photo at left shows the compartment for batteries and motor-generator set. Lower photo shows the pair of brake shoes. One or several pair may be used, depending on requirements. Ask us for more information.

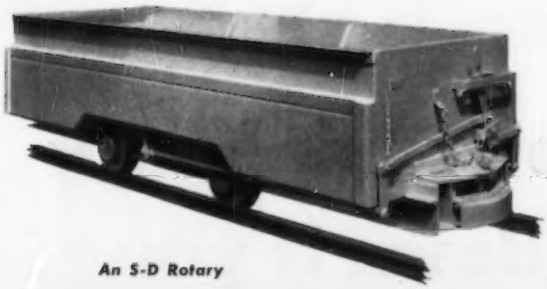




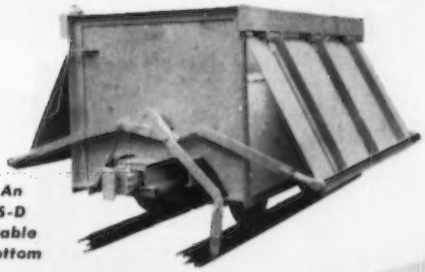
An
S-D
Rocker



An S-D Heavy-Duty Rocker
with outside frame construction



An S-D Rotary



An S-D Gable Bottom

Market for mine cars

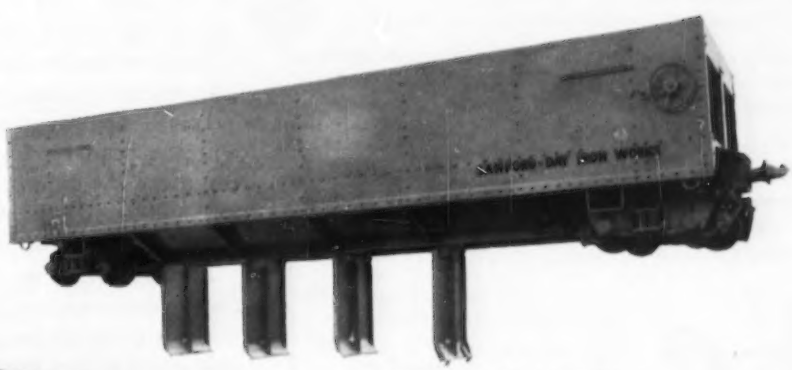
An S-D Skip

IS THERE SOMETHING SPECIAL you need in mine cars—a feature to meet your particular requirements? You probably will find the answer in our plant. Down through more than 50 years of car building experience we have solved the major problems of mine haulage.

Regardless of the type car you need, we build it . . . cars so constructed to give you more years of service with the least maintenance. Shown here are but a few of scores of all types S-D Mine Cars regularly being built for metal and non-metallic mines. All are designed and constructed to give superior service for the lowest dollar. Whether you need one car or 101, don't hesitate to get one of our engineers into your mine—face-to-face with your problem. With this type of cooperation, plus our facilities and capacity to build any type mine car of any size, any haulage problem in your mine can be solved. *SANFORD-DAY IRON WORKS, Telephone 3-4191, P. O. Box 1511, Knoxville, Tenn.*

An S-D Automatic

● ASK US ABOUT THE S-D GISMO . . . the self-loading transport that promises big new economies in mining. It merits thorough investigation by any firm excavating rock or its equivalent.



An 8-wheel S-D Automatic

An S-D Automatic with spring-mounted trucks

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MINE CARS, All Types - PRECISION WHEELS - "Brownie" HOISTS CAR RETARDERS - SPOTTERS PUMPS - OIL SPRAY SYSTEMS

you can't knock it down if you don't drill it first

Easily-damaged, undependable cable is not cheap at any price. This is particularly true of open pit mining operations where the economical operation of much expensive equipment rests on its ability to keep working through each and every shift.

It is in such situations as this that TIREX Cables with their cured-in-lead, Selenium Neoprene Armor can mean the difference between a smooth-flowing job and one with stop-and-go operations. Only smooth-flowing jobs have low costs.

Portable cables are particularly subject to abuse and to deterioration from weather. Since they are the only pathway for power, isn't it just good common sense to buy the best portable cables you can find for powering your drills? That means TIREX, of course. TIREX has the toughest, most abrasion-resistant jacket available on a portable cord or cable. That's why we say be sure you specify and then be sure you get TIREX.

Simplex

TIREX CORDS AND CABLES *are made only by the*

SIMPLEX WIRE & CABLE CO., 79 Sidney St., Cambridge 39, Mass.

End earth-mover tube and flap troubles!

All earth-mover and grader types, Wide-Base or Regular — at same prices as Conventional Tires with tubes!

Latest Goodyear "Firsts"—

TUBELESS TIRES Built with 3-T NYLON CORD plus EASY-MOUNTING TRU-SEAL RIMS

eliminate major causes of down time on all earth-mover and grader vehicles!

If you're wondering whether giant-size tubeless tires can be safely mounted—whether they really *hold* air—whether their savings in cash, time and trouble make them worth-while—GOODYEAR HAS THE PROVED ANSWERS!

Proof one—on actual commercial operations and construction jobs of all kinds, no serious tire or rim trouble has been reported!

Proof galore—unconditionally enthusiastic reports from independent operators add up to this:

NO MORE EXPENSIVE DOWN TIME because of tube and flap trouble!

NO MORE EXPENSIVE TUBE REPLACEMENT—a big factor on many jobs where tires outlast 2 or 3 tubes!

FASTER, EASIER MOUNTING AND DISMOUNTING—no more double inflation, no more tubes and flaps to handle—NO complicated mounting methods to learn!

TRULY AIRTIGHT ASSEMBLY—Goodyear's exclusive 3-T NYLON CORD forms an airtight chamber—and Tru-Seal rims *hermetically seal* the assembly!

COOLER RUNNING than conventional assemblies—means greater safety, longer tire life!

SLOW LEAKS INSTEAD OF BLOWOUTS—small, unnoticed injuries lead to blowouts in conventional tires. In Goodyear tubeless earth-mover tires, they may be detected and repaired *before* costly, dangerous damage!

SIMPLER, RE-USABLE VALVE-PARTS—Goodyear's tubeless valve program means fewer parts to stock, lower cost parts that can be used over and over again!

Leading equipment manufacturers are going Goodyear tubeless—with Tru-Seal rims. Specify them in the new wide-base or conventional cross sections and say goodbye to tube and flap troubles forever!

Goodyear, Truck Tire Dept., Akron 16, Ohio.

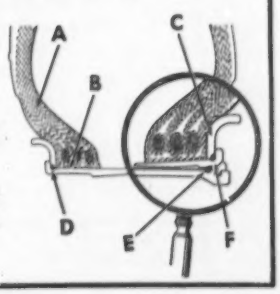
How Goodyear Engineering assures Quick, Airtight, Tubeless Assemblies:

(A) 3-T NYLON CORD plies prevent air-seepage through tire.

(B) Same 5° taper bead-base hugs Tru-Seal rim.

(C) Tru-Seal rim employs same general mounting principles as conventional rims.

(D, E, F) Tru-Seal rubber rings press into locking grooves, hermetically seal entire assembly—*automatically!*



GOODYEAR TIRES

Look for this sign; there's a Goodyear dealer near you.

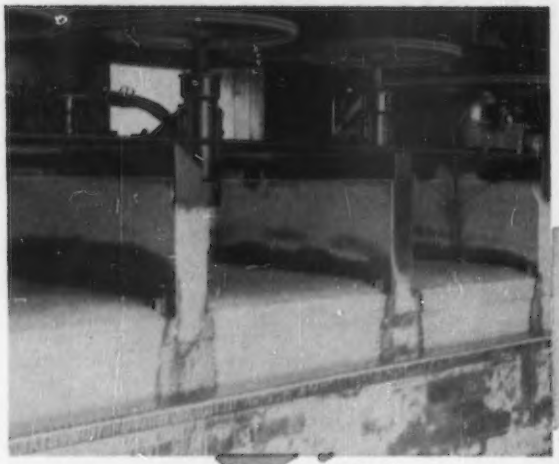
Buy and Specify

GOODYEAR

MORE TONS ARE HAULED ON GOODYEAR TIRES THAN ON ANY OTHER KIND!

Tru-Seal—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

AGITAIR® is there!



. . . recovering gold from cyanide tailings in Southern Rhodesia

This unusual flotation circuit in Southern Rhodesia—AGITAIR® cells, with tank assemblies built of brick—is another notable example of AGITAIR® versatility in adapting to local problems. This successful application is the treatment of sand fraction of old cyanide tailings, handling 8,000 tons per month after desliming.

Here, as in many other ore centers throughout the world, AGITAIR® adapts to the local requirements of mill and metallurgy . . . yields maximum recovery at lowest operation cost. AGITAIR® is serving both metallic and non-metallic industries with results that have equalled or exceeded pilot plant findings. Write for information.

Leaders in Experience and Service

GALIGHER PRODUCTS

Commercial and Laboratory AGITAIR®
VACSEAL Pump
Vertical VACSEAL Pump
Acid-Proof Sump Pumps
Laboratory Ball Mills
Geary-Jennings Sampler
Geary Reagent Feeder
Laboratory Pressure Filters

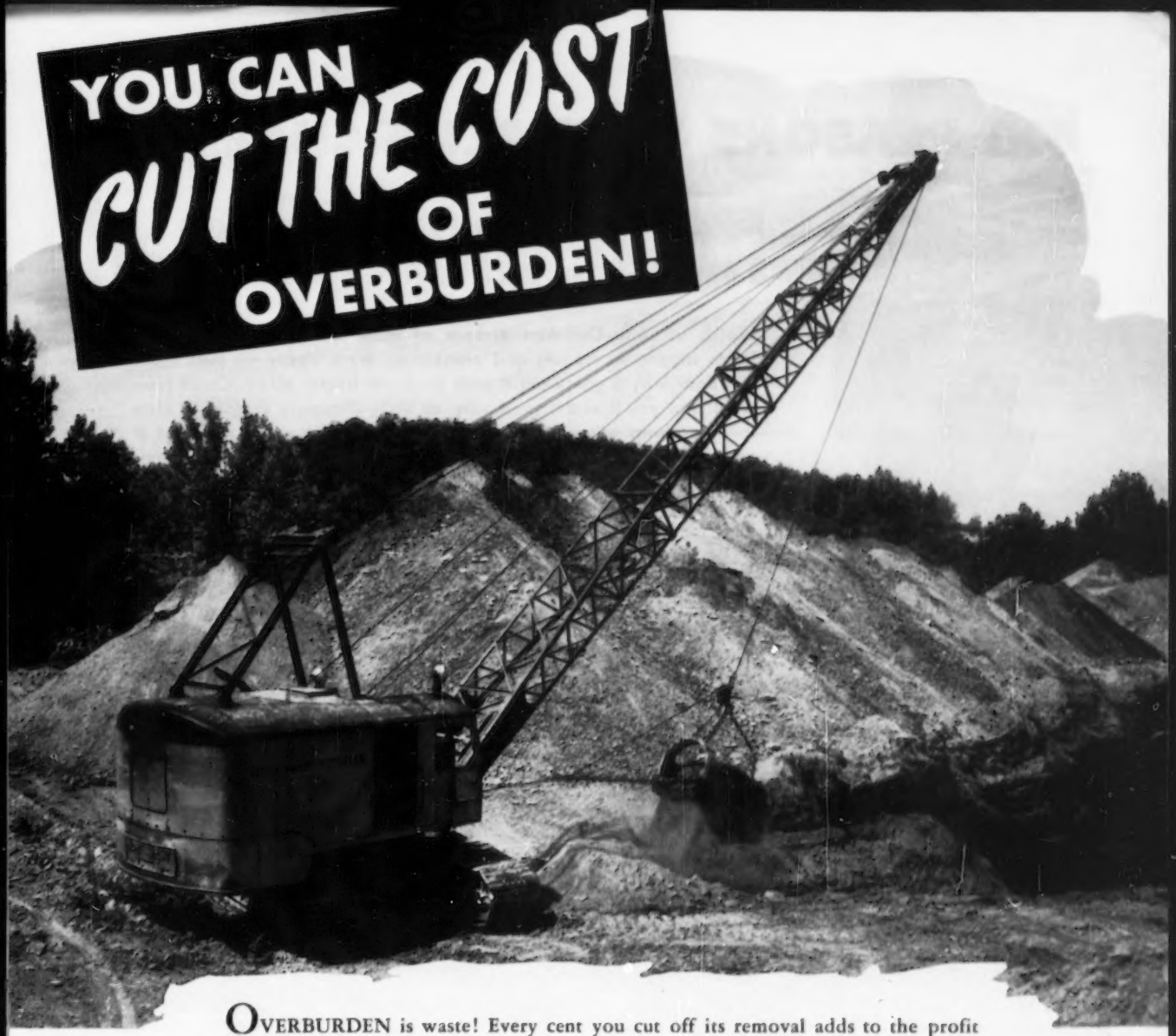
THE GALIGHER CO.

METALLURGICAL DIVISION • ENGINEERING SERVICE

CONSULTATION • ORE TESTING
PLANT DESIGN • GEOLOGIC INVESTIGATION

Home Office: P. O. Box 209 Salt Lake City 10, Utah
Eastern Office: 921 Bergen Ave. (Room 721) Jersey City 6, N.J.

YOU CAN CUT THE COST OF OVERBURDEN!



OVERBURDEN is waste! Every cent you cut off its removal adds to the profit of your ore.

There are many operations in which a Northwest will cut the cost of handling overburden. Fast operation, the smooth control that comes with Northwest Uniform Pressure Swing Clutches and the "Feather-Touch" Clutch Control means more bucket loads dumped per hour and under many conditions more output than larger rigs. Positive traction on both crawlers while turning as well as when going straight ahead assures easier travel in the often rough conditions encountered when handling overburden, and simplicity of design makes upkeep easier and less costly in the remote locations characteristic of mining operations.

Northwest brings you a combination of advantages found in no other similar equipment—the "Feather-Touch" Clutch Control for easy operation, Northwest simplicity of design for easier upkeep, Uniform Pressure Swing Clutches, Northwest Steering, Cast Steel Machinery Side Frames, the Cushion Clutch, the Northwest Dual Independent Crowd—all combine for greater output at lower cost. You can't have too much dependability where profits begin. You can plan to have Northwest performance. Why not talk it over with a Northwest man and let him tell you how?

NORTHWEST ENGINEERING COMPANY
1509 Field Bldg., 135 South LaSalle Street, Chicago 3, Illinois

YOU CAN'T HAVE NORTHWEST ADVANTAGES UNLESS YOU OWN A NORTHWEST

NORTHWEST

Convertible for any Mining Material Handling or Excavation Problem

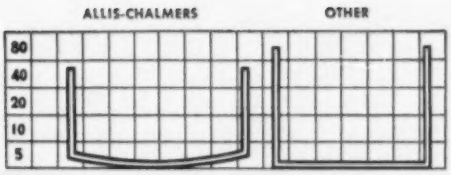
DRS-1-LG

5 BIG REASONS WHY ALLIS-CHALMERS move more dirt at

Watch an Allis-Chalmers scraper at work and you'll see that it loads bigger — travels and maneuvers more easily — puts more dirt right where you want it with the least tractor effort. Check features and you'll understand *why* an Allis-Chalmers scraper is able to outperform others. Then compare prices and you'll see that it gives you more scraper capacity per dollar — more for your money in every way.

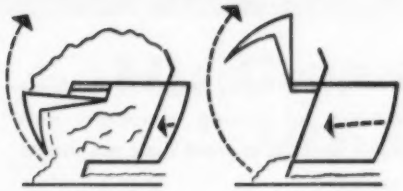
STRIPPING AND RECLAIMING IN ONE OPERATION. This Allis-Chalmers Model 315 Scraper strips overburden, then deposits and spreads it in a worked-out area of the pit. It has a struck capacity of 15 cu yd (19 cu yd heaped) and incorporates all the job-proved advantages found in other Allis-Chalmers scrapers, 2 to 19 heaped capacities.

SCRAPERS
lower cost



2 LESS LOADING RESISTANCE

Low, wide bowl plays an important part in ease of loading. Since loading resistance is largely determined by the height to which the load is built, the lower, wider bowl of an Allis-Chalmers scraper requires less time and power to get the same yardage as other scrapers.

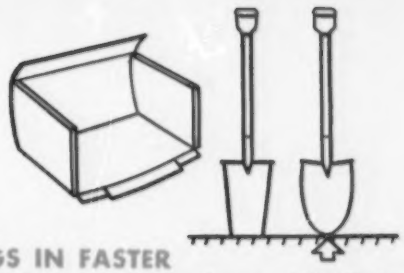


4 POSITIVE EJECTION ASSURES EVEN SPREADING

With patented linkage, apron lifts, then moves forward and up as ejector pushes foward. High apron lift prevents any possibility of material's jamming. Even when loaded from overhead, anything that can be put into the bowl can be easily ejected. Ejector returns to loading position automatically by spring action and apron weight.

• • •

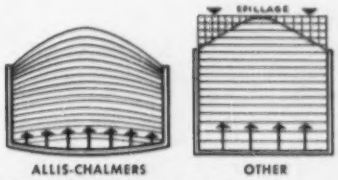
There is an Allis-Chalmers pull-type scraper for every tractor . . . every job. Write for literature or contact your Allis-Chalmers dealer.



1 DIGS IN FASTER

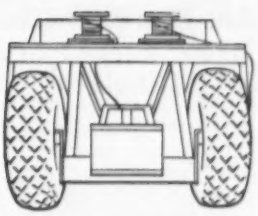
Curved and offset cutting edge on Allis-Chalmers scrapers concentrate all the tractor horsepower on the center section during initial penetration. The penetrating ability of a round-end spade helps illustrate the soundness of this Allis-Chalmers design.

Diagrams show how an automatically heaped load avoids costly spillage even though the center is built up above the sides of the bowl.



3 HEAPS AUTOMATICALLY

The combination of slightly deeper center cut and correctly angled cutting edge shapes the load as the scraper fills. The greater volume of dirt flowing into the center of the curved bowl "boils" forward, to the rear and to the sides, pulverizing the dirt, filling the voids and producing an automatically heaped load without excessive spillage.



5 HAULS, MANEUVERS EASILY

Big, low-pressure tires provide maximum flotation. The extra wide, low bowl keeps center of gravity low, helps the scraper hug the ground for safety. Front running gear has ample clearance at all points, high carrying position clears uneven ground.

Scraper main frame is shorter because exclusive linkage moves apron forward as well as upward to clear main frame at full height. The two-to-three feet shorter wheel base permits easier maneuvering. Scraper can turn in its own length.

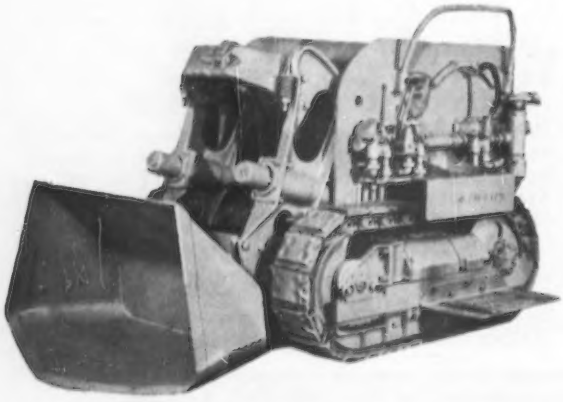
CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

5 Months Maintenance Cost — $0.00

"We've operated this machine for over five months every shift and haven't spent a cent for parts." This is a typical statement from operators of Eimco's crawler mounted air and electric powered loading machines.



Eimco developed the 630 series of trackless loading machines for mining companies and contractors who wanted to work their properties on a trackless basis.

These small machines are the essence of agility and toughness. Equipped with an 11 cu. ft. bucket they will load ordinary heavy rock and ore at the rate of three tons per minute. They're ideal for the toughest jobs and are at present handling production in mines, and sinking hard rock shafts.

Eimco 630 crawler loaders weigh approximately 9400 lbs. and are self-propelled with independent track control. Tough alloy steel castings are used throughout for impact and abrasion resistance.

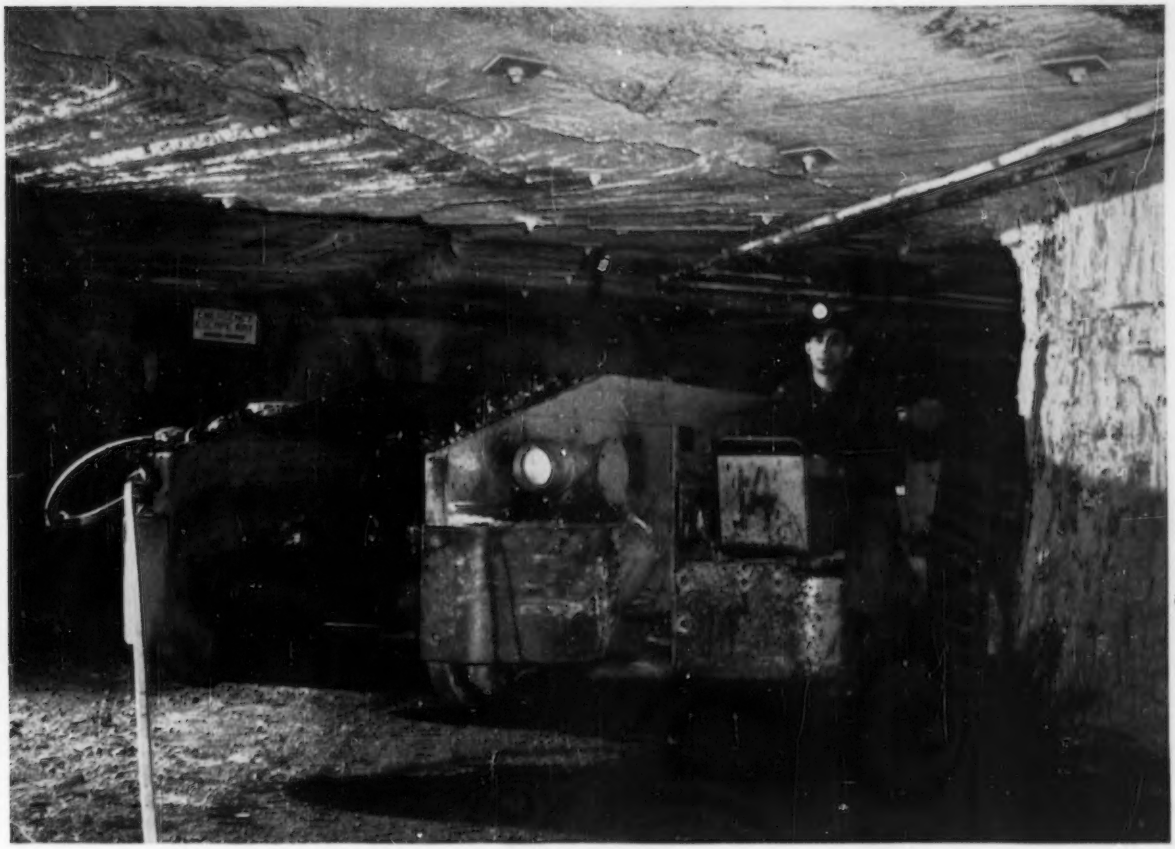
When you need low cost, high production loading equipment see Eimco first.

THE EIMCO CORPORATION

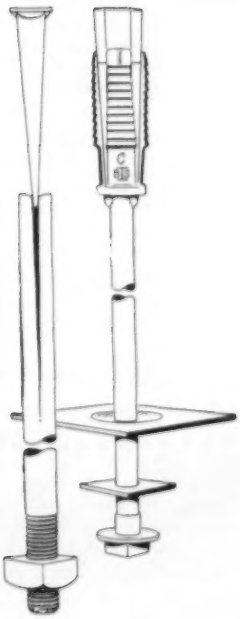
Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Seattle, Wash. Pasadena, Calif. Houston, Texas Vancouver, B. C. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

B-158



Up Goes Production... When Roof Bolts Go In



When you equip your mine with roof bolts, production is increased because of the wider openings and clearances, and increased room in which to operate mechanized equipment. And with large, old-fashioned supports out of the way, ventilation is improved.

Roof bolts make larger work area possible, and permit a tight, sound roof, because they consolidate strata into a single-unit thick beam. Such roof control promotes safety by minimizing the possibility of serious roof falls.

4 Types of Bethlehem Roof Bolts

SLOTTED BOLT. This husky 1 in. bolt has a centered slot which is made by forging, without any loss of metal. Other end of bolt has 5 in. of rolled threads. Bolt is used with steel wedge, which is forced deep into slot, expanding the bolt-ends, when bolt is driven in 1¼ in. hole. Bolt has truncated-cone point to prevent thread damage. Normally furnished with American Standard regular square nut.

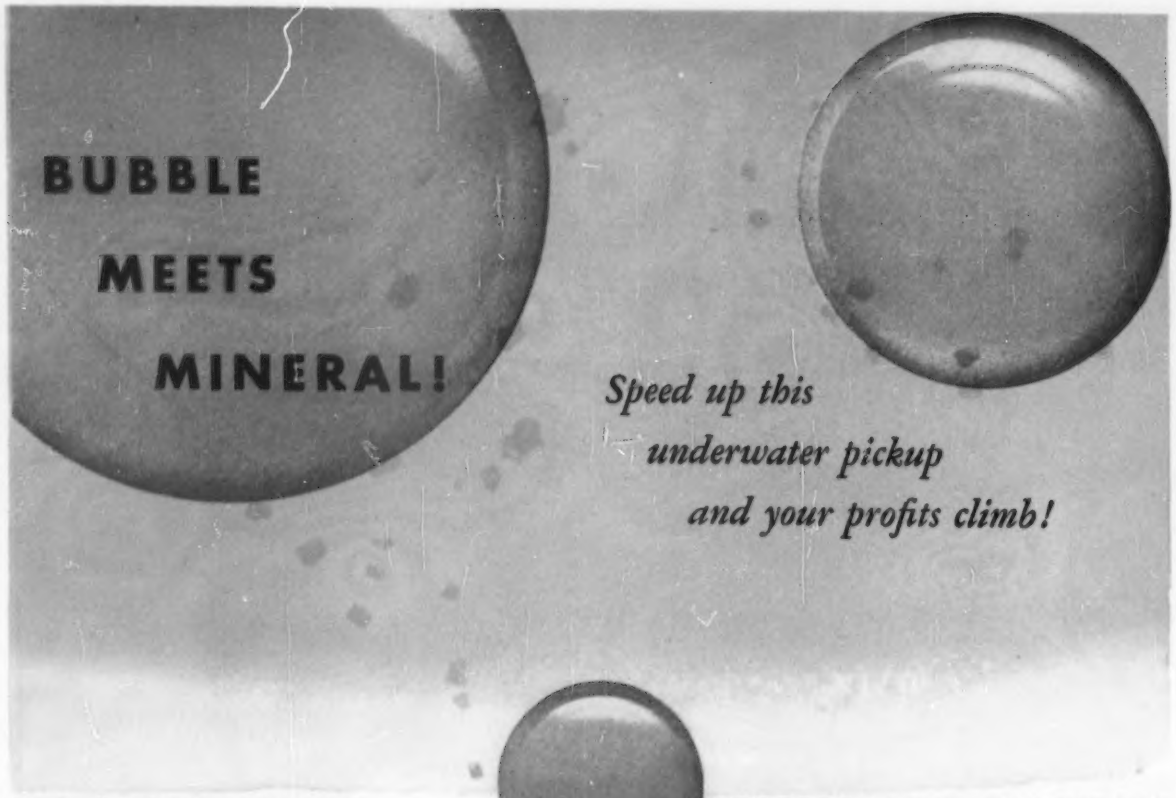
SQUARE-HEAD BOLTS. Three types: a ¾ in. carbon-type, and a ⅞ in. high-strength bolt, each with typical breaking load of 24,000 lb; also a ⅞ in. high-strength bolt with typical breaking load of 45,000 lb. The ¾ in. and ⅞ in. bolts can be used with Bethlehem's matching-halves Type F expansion shell or the 4-leaf Type C expansion shell. The ⅞ in. bolt is for use with the Type F shell in 1½ in. hole.

HARDENED WASHERS. Bethlehem's hardened washer for use with headed bolts reduces the friction between bolt head and roof plate that occurs when high tension in the bolt produces excessive bearing pressure. With this washer, impact wrenches can be used freely, without galling or tearing of metal.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL



Armour flotation reagents compel the fastest attachments known —selectively float higher concentrations in less time for as little as 7¢ per ton!

The coating reaction between an Armour flotation reagent and the *specific* mineral you want is instantaneous. The Armour-treated minerals then attach quickly and firmly to rising air bubbles. As a result, you achieve a higher percentage of mineral recovery—along with increased throughput. You use less equipment, too, because the sharp selectivity of Armour cationic flotation reagents enables you to recover minerals without using an extra cleaner flotation step. And you can float the minerals from one ton of ore for as little as 7¢!

Armour produces a wide range of both cationic and anionic flotation reagents. For information and samples, send the coupon at right. Or write us, if you have a specific separation problem. Whether you want to float your minerals to concentrate them or reject them, we can suggest an Armour flotation reagent which will float more of the exact minerals you want *one by one*—in less time and at less cost.

PROVEN SEPARATIONS

Amblygonite • Barite • Beryl • Cement Rock
Chromite • Feldspar • Fluorspar • Hematite • Ilmenite
Kaolinite • Manganese • Mica • Phosphate • Potash
Salt • Scheelite • Silica • Spodumene • Syenite
Talc • Vermiculite

For test samples and information on how Armour flotation reagents can increase *your* recovery percentages, describe briefly the separations in which you are interested and send this coupon to the address below, today.

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E1

Specialists in Flotation Chemicals

ARMOUR
CHEMICAL
DIVISION

© Armour and Company, 1355 W. 31st., Chicago 9, Ill.

Clean-up takes only a few minutes per shovel because of Tournatractor's 19 mph forward and 8 mph reverse speeds. In addition to saving time, speedy tractor-on-rubber keeps loading sites and haul roads cleaner because it can get around to each shovel more times per day than a crawler-tractor.

Kaiser Steel Corp.

speeds mine clean-up with Tournatractor

1 rubber-tired rig replaces 2 crawler-tractors

Working their Eagle Mountain Iron Mine, Eagle Mountain, California, Kaiser Steel Corp. find they get more clean-up work done faster with 1 Model C Tournatractor than if they assigned 2 crawler-tractors to handle the same job. The new tractor-on-rubber replaced one full-time crawler, and does the part-time plant and pit maintenance work formerly assigned to a second track-type machine. The change to the faster, more maneuverable 208 hp Tournatractor enables the mine to keep haul units moving with less delays due to spillage or uneven pit floors.

3 to 4 times faster than crawlers

Tournatractor handles all clean-up assignments around 3 shovels. It shuttles back and forth at speeds up to 19 mph, which is 3 to 4 times faster than the top speed of any crawler. In addition, reverse speeds to 8 mph allow unit to back away quickly without interfering with loading operations. Big 21.00 x 25 low-pressure tires provide plenty of flotation and traction. They stand up well despite abrasive and rocky footing around pit floor.

Also used for pulling and pushing

In addition to clean-up and bulldozing, the 208 hp tractor pulls air compressors to drilling sites and moves the frame supports which carry electric cable for shovels, drills, and other equipment.

Get all the facts

Mine owners around the world are taking advantage of the ease of maintenance, durability, speed, and high production of the Tournatractor. If you are interested in these same benefits for your mine, get all the details from your Distributor today.

Tournatractor—Trademark Reg. U.S. Pat. Off.T-828-M-b

Tournatractor also cuts downtime for air compressors and other equipment when moving them from one location to another. Tournatractor gets on the job quicker . . . gets to the next assignment quicker. 1500 ft. is less than a minute away.

LeTourneau-WESTINGHOUSE Company

Peoria, Illinois

A Subsidiary of Westinghouse Air Brake Company

All costs considered -- belt conveyors by LINK-BELT are your most effective means to

GREATER TON-MILE ECONOMY

Efficient, economical handling of bulk materials is provided by this 260-ft. Link-Belt conveyor with 24-in. wide belt. These conveyors can travel up or down grades as steep as 32%.

For large or small systems -- you get unrestricted selection of components and unmatched engineering background

CONTINUOUS operation, large capacity, flexibility, ease and infrequency of maintenance — belt conveyors offer many advantages unmatched by any other kind of bulk material transportation. And when they're supplied by Link-Belt, you enjoy additional benefits through unbiased choice of components and vast engineering experience.

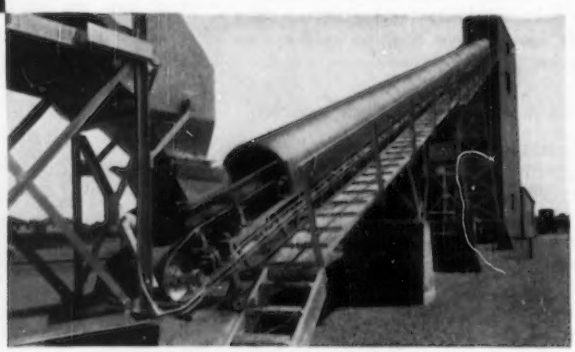
Link-Belt equipment includes a complete line of idlers, trippers, drives, terminal machinery and other items. We can recommend the most practical combination for your particular job, with all elements having correct-rated capacities.

As for experience, Link-Belt is qualified by scores of installations in every industry. In fact, Link-Belt has been a pioneer in the development of belt conveyors for long or short hauls, indoor or outdoor service. As a result, our recommendations are based on methods proved successful in applications similar to yours.

Your Link-Belt office will gladly fill in details on how belt conveyors can lower your handling cost per ton-mile. Call today.

LINK-BELT

BELT CONVEYOR EQUIPMENT



Bearings, drives, supports and enclosures as required in this installation are also made by Link-Belt. Availability of all elements from one source saves delays and complications.

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World. 13.950

Ride the new "660"

150 hp...8 forward speeds...does more work in less time!

The best way to judge a horse . . . or a car . . . or a grader, is to ride it. Get behind the wheel of a modern Adams "660" and see for yourself!

You'll find the big diesel engine starts readily in any kind of weather. Convenient and positive-acting power-controls raise, lower, revolve, or extend the 12-ft. blade to any desired position.

Pull the throttle and feel the surge of power. Set the blade for a deep cut, then watch the dirt boil over-and-out as the big tires take hold, and see how the machine hangs on to occasional over-loads. Note how Adams constant-mesh transmission provides easy gear shifting with no clash of spur gears.

Flexible speed range means more work per day

Eight forward speeds (1.4 to 25 mph) provide the necessary wide speed range to handle all operations at the fastest practical rate. Three additional "creeper speeds" (.23 to 1.82 mph) are optional. These "slow motion" speeds *gear* the grader to extra-low speeds — no need to slip the clutch. Make it easy to rip up rocky and rooty terrain with less shock to the grader. Creeper speeds are important, also, for accurate finishing in tight places. *No other grader offers this wide range of eleven forward operating speeds.* They mean *more* and better work done, in *less* time, also mean a big saving in downtime and maintenance.

4 Reverse speeds (1.8 to 13 mph)

This wide range of backing speeds saves time on every cycle. You can back at 13 mph for a second cut. Or you have a good range of working speeds for grading or mixing on the reverse part of the cycle. This reverse range provides extra safety, extra accuracy for maneuvering.

Applying double-action hydraulic brakes to wheels also brakes transmission . . . gives greater safety in quick, sure stops, with less pedal action, less strain on machine.

Leaning front wheels balance the pull of the blade, give more accurate control on slopes, reduce stress, make steering easier, safer.

Engine rubber-mounted. No engine vibration is transmitted to grader to annoy and fatigue the operator. Means better operator satisfaction and efficiency.

See the "660" ADAMS before you buy any grader

Judge your next motor grader on the basis of *performance*. Ask your LeTourneau-Westinghouse Distributor to show you a "660" in action. Ride one of these machines. Find out for yourself why Adams motor graders do *more* work, in *less* time, at *lowest* cost.

Equipped with dozer-blade, Adams grader backfills, dozes trees and stumps, push-loads scrapers, moves debris off right-of-way, fills in around culverts, and does "handy-man" jobs usually assigned to special tools. With V-type snow-plow "660" can buck heavy drifts.

Operator on any Adams grader can move blade from ditch to bank-cutting position in less than a minute. Horizontally he can reach up to 7½' outside the wheels. Blade is fully reversible . . . note high 28" clearance under front-axle for straddling high windrows.

A size ADAMS for every need

Model 660 — 150 hp diesel, 27,730 lbs. A big grader for big jobs—high production on construction work.

Model 550 — 123 hp diesel, 23,500 lbs. Heavy-duty, all-purpose machine, outworks anything in its class.

Model 440 — 104 hp diesel, 21,500 lbs. A good producer on all average grading and maintenance work.

Model 330 — 80 hp diesel, 20,500 lbs. A good general-purpose machine with surprising capacity.

TraveLoader — high-speed, heavy-duty, self-propelled, belt-type loader. Loads trucks from windrows or stockpiles.

AG-3-G-b

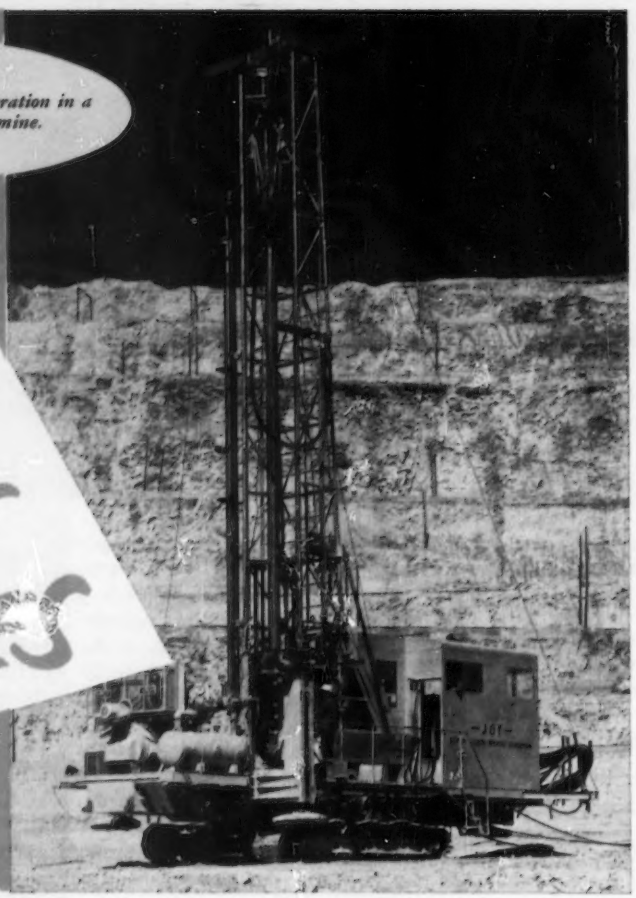
LeTourneau-WESTINGHOUSE Company

Peoria, Illinois

A Subsidiary of Westinghouse Air Brake Company

Here's the drill you need for LARGER, LOWER-COST BLASTHOLES

Joy 60-BH Drill in operation in a large Southwest copper mine.



the JOY 60-BH Super Heavyweight Champion

For high-production open pit mining of copper, as illustrated above, large-diameter blastholes are a *must!* The way to drill those large-diameter holes economically—either in copper ore, or in any other open-pit mining or overburden removal job—is with the Joy 60-BH Super Heavyweight Champion. Here's why: because this Joy rotary drill excels in all three of the features which determine bit penetration:

ROTATION—Infinite variation of bit speeds, accurately controlled bit speeds, more power on bit rotation, and constant indication of bit speed and pressure by gauges.

BIT WEIGHT—The Joy hydraulic feed, using two 5-foot hydraulic cylinders, is the most efficient and dependable method of applying bit pressure. It is more accurately controlled and less hazardous than other methods.

CUTTINGS REMOVAL—Only Joy uses a heavy-duty, industrial-type, water-cooled air compressor to insure more dependable air supply required for efficient rotary-air blast drilling.

Other features include a self-aligning hydraulic automatic chuck, hydraulically raised and lowered derrick, and rod handling device.

The 60-BH, capable of drilling 9" to 12" diameter holes in even the hardest rock formations, is the largest in the outstanding line of Joy Champion "rotary-air blast" drills. Smaller models are the 58-BH Heavyweight for 7⅞" diameter holes, and the 56-BH Middleweight for 6¼" diameter holes. Let us quote on *your* requirements. *Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.* In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Write for FREE Bulletin 35-4

Consult a Joy Engineer

For AIR COMPRESSORS, ROCK DRILLS, CORE DRILLS, HOISTS and SLUSHERS, MINE FANS and BLOWERS

WSW MS606-35

JOY

WORLD'S LARGEST BUILDER OF CORE DRILLS, ROTARY BLAST HOLE DRILLS AND MOTORIZED DRILL RIGS

Why the Big "B" Rear-Dump

can cut your hauling costs

Speeds to 34 mph

The new 35-ton capacity B Tournapull Rear-Dump has 10 forward speeds, from 2 mph to 34 mph . . . 2 reverse speeds, 2 and 4 mph. Rapid shift and quick acceleration of 293 hp diesel engine lets you move faster and easier into higher gear ranges.

Improved gradability

Proper distribution of weight forward onto drive wheels allows "B" to go up steep grades.

Fast loading

Large "target" area makes loading fast and simple. Bowl is 17'8" long, 10'2" wide, has maximum depth of 7'6". Rear of body provides wide, low entry which gives excavator faster loadings.

Fingertip control of dumping

The touch of a switch, activates hoist motor to lift body. As body lifts quickly, it swings behind rear wheels to dump clean. Completely streamlined bowl sheds material readily. There is positive control both up and down.

Rugged Construction

Body is heavy steel plate, rigidly reinforced. Three layer bottom consists of heavy bottom plate, thick steel billets and heat treated steel strips to resist wear. Main case of prime-mover is built extra strong . . . will not distort to put strain on power-train.

No hydraulics, springs or hinged steering connections

Problems of conventional rear-dumps are eliminated by simple design of "B" Rear-Dump. Troublesome hydraulics, long driveshafts, springs, spring hangers and hinged steering connections are eliminated. Improved hauler means higher mechanical efficiency and lower maintenance costs on all hauling jobs.

See your LeTourneau-Westinghouse Distributor about the new "B" Rear-Dump today. He can also show you how this unit can be interchanged with a Scraper or Crane, at only about 25% of original total price.

Tournapull—Trademark Reg. U.S. Pat. Off. BR-889-G-b

LeTourneau-WESTINGHOUSE Company

Peoria, Illinois

A Subsidiary of Westinghouse Air Brake Company

Here's the New R-15 "Euc"

that sets a new high in 15-ton Rear-Dump Performance!

DUMPS FAST AND CLEAN

Smooth body interior and tapered rear chute assures clean shedding of the load well back of the rear wheels—an important feature for dumping into hoppers or over the edge of waste banks. Lycoming Silica Sand Co. in Pennsylvania has used 15-ton "Eucs" for years and now has added two R-15 Rear-Dumps to their hauling fleet.

STAY ON THE JOB LONGER

Victorville Lime Rock Co. in California uses 2 Model R-15 "Eucs" for hauling rock and overburden. Rugged body and frame withstand the impacts of loading, hauling and dumping heavy excavation in construction, mine and quarry service.

Built for heavy off-the-highway service, 15-ton Rear-Dump "Eucs" have paced the field for over 20 years. They've reduced hauling costs on hundreds of the toughest jobs in mine, quarry and construction work . . . delivered "plus" performance year in and year out.

This model R-15 incorporates the engineering advances, the easy operation and maintenance features, resulting from unequalled field experience with other Euclid Rear-Dumps of the same capacity. It provides the dependable work-ability that means more payloads per day at lowest cost per ton or yard moved.

Have your Euclid dealer give you full details on this new 15-ton Rear-Dump and the complete line of Euclid earth moving equipment. He'll be glad to show you why so many users have proved for themselves that ***Euclids are your best investment.***

EUCLID DIVISION GENERAL MOTORS CORPORATION, Cleveland 17, Ohio

The R-15 is your BEST BET for Lower Hauling Costs!

Advanced design results from 20 years of leadership in building off-highway Rear-Dumps

Some of the OUTSTANDING FEATURES of the R-15

- 10½ yd. body 30,000 lb. payload
- 218 h. p.
- loaded top speed of 25 m.p.h.
- hydraulic booster steering
- air assist clutch
- free floating springs
- 14.00 x 24 drive tires (16.00 x 25 optional)

POSITIVE CONTROL OF DUMPING

Double-acting 3 stage Euclid hoist and hydraulic system gives the operator fast, positive control of the body position at all times. Dumping angle of the body, in fully raised position, is 68°. Body, frame and hoist are designed and built as an integral unit. McDowell & McDowell are using six R-15 "Eucs" to haul heavy excavation at a big plant site job in Nashville, Tennessee.

SPEED AND STABILITY

The 5 speed transmission and Euclid planetary axle provide a top speed of 25 m.p.h. with full 15 ton payload . . . 27 m.p.h. with 16.00 x 25 tires. Free floating Euclid spring suspension gives maximum stability empty or loaded under all road conditions . . . permits faster safe travel speeds. Dale Bloom had a fleet of 6 Rear-Dump "Eucs" on this Kansas Turnpike job—2 of them the Model R-15.

EASY OPERATION

Full width cab offset to left for maximum vision, air assist clutch, booster steering, 218 h.p. engine, fast acting hoist, free floating springs and fully adjustable seat contribute to driver comfort and easy operation. Four of these new Rear-Dumps worked on a highway relocation job of W. J. Menefee Construction in Missouri.

Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE

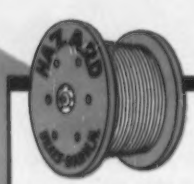
Bessemer

operation proves that Hazacords can take punishment

All the units in this operation are "big bruisers", selected for ability to operate on a big scale under the most difficult conditions. At this Bessemer Limestone and Cement Company limestone quarry the five-cubic-yard dippers can load at the rate of 400 tons per hour. The blasting, rock dust and rough ground mean that only top quality materials can keep all operating equipment from trucks to electrical cables continually on the job.

Operating at 4160 volts, the Hazacord Type SH-C, 5-kv portable cables have proved themselves able to withstand the worst treatment this operation can provide. The extremely durable Hazaprene ZBF sheath is excellent protection against the constant scraping, twisting and dragging that is normal in this type of operation. Hazard Keystone rubber insulation and shielded construction provide long electrical life and maximum protection for personnel when handling the cables.

No matter what the type of installation, there is a Hazard cable that will handle power distribution up to 15,000 volts. Ask your Hazard representative or write Hazard Insulated Wire Works, Division of The Okonite Company, Passaic, New Jersey.



HAZARD
insulated cables

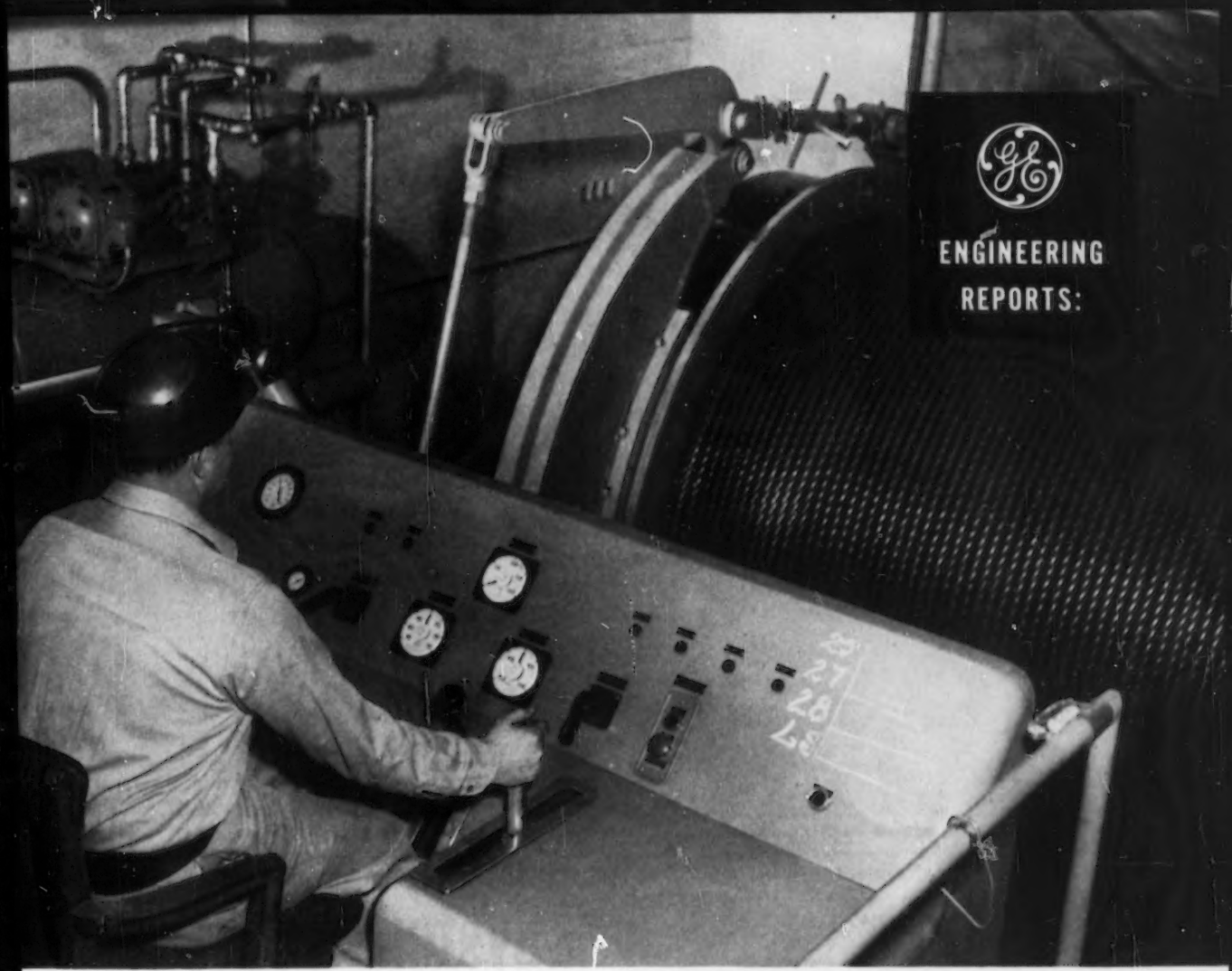
PRODUCT OF OKONITE RESEARCH

2445

Overall shielding on this Hazacord high voltage cable reduces hazards of shock to men who come in contact with the cable during operation.

Hazacords are known for their reliability in blasting operations such as this where there is constant threat from impact and sharp uneven surfaces.

Hazacords give long service even when dragged continuously over rough, destructive terrain like that shown here.



CUSTOM-BUILT G-E manual or automatic mine hoist drives are available in many types for heavy-duty hoisting.

G-E electrical systems and equipment help you . . .

Mechanize underground mining for more tonnage at lower cost

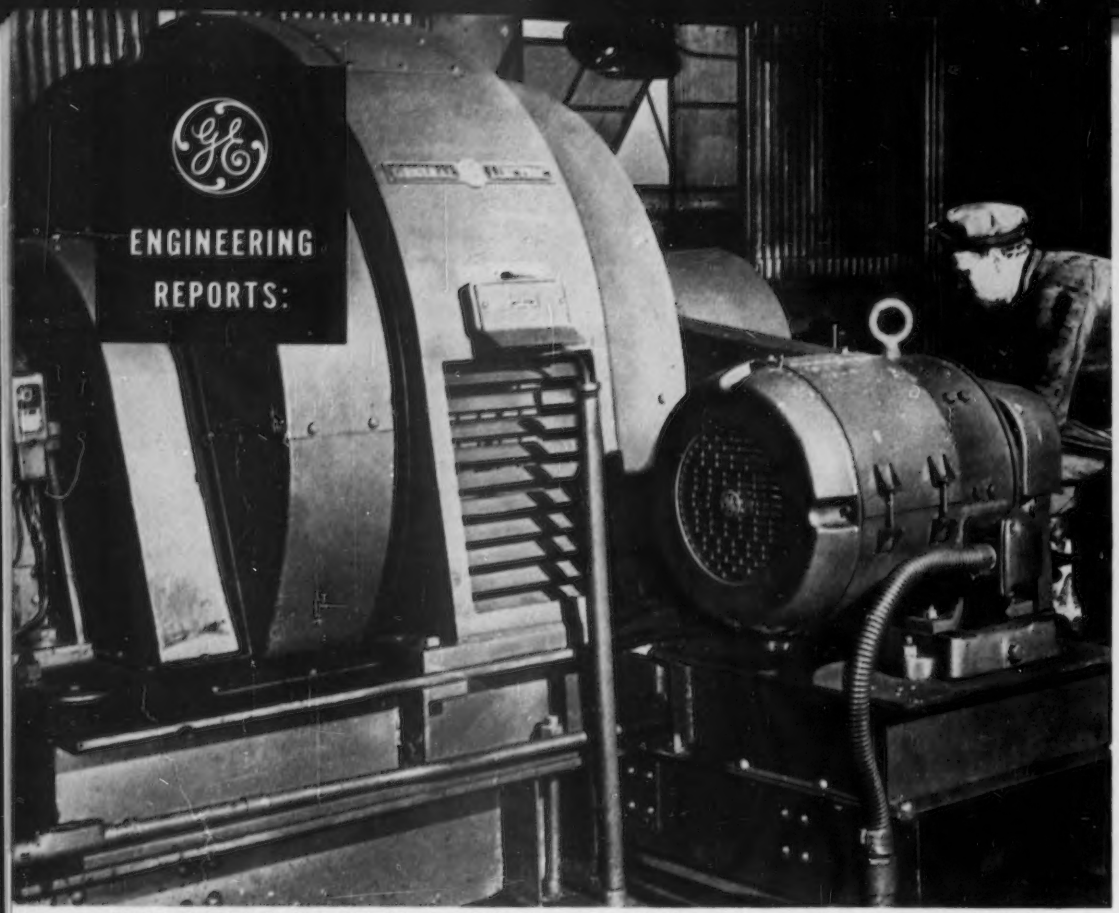
As market conditions change, underground mines must produce more, faster, and more efficiently, to improve their competitive position. Key to this objective is increased mechanization, with General Electric's help.

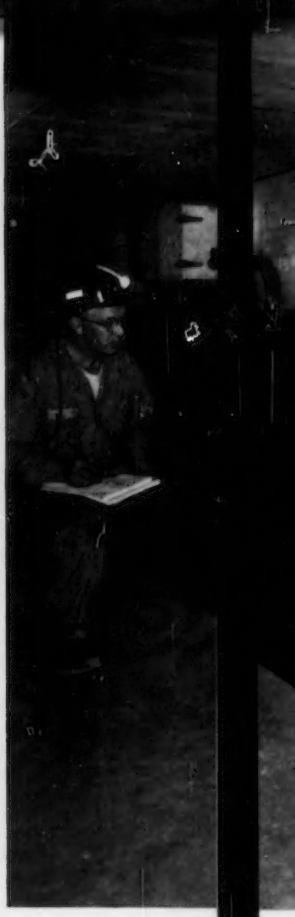
You benefit many ways when you specify G-E electrical systems and equipment. Advantages like these can play an important part in your mine mechanization program:

- **FACTORY-ASSEMBLED** G-E power-system equipment cuts installation time and cost, speeds new construction and start-up.
- **SPACE-SAVING** G-E electrical equipment adapts readily into existing systems, can be expanded easily, at low cost.
- **LOW-MAINTENANCE** G-E drives are designed to last longer, provide more horsepower in limited space, with maximum accessibility for servicing.

TURN PAGE FOR MORE PRODUCT INFORMATION

GENERAL ELECTRIC

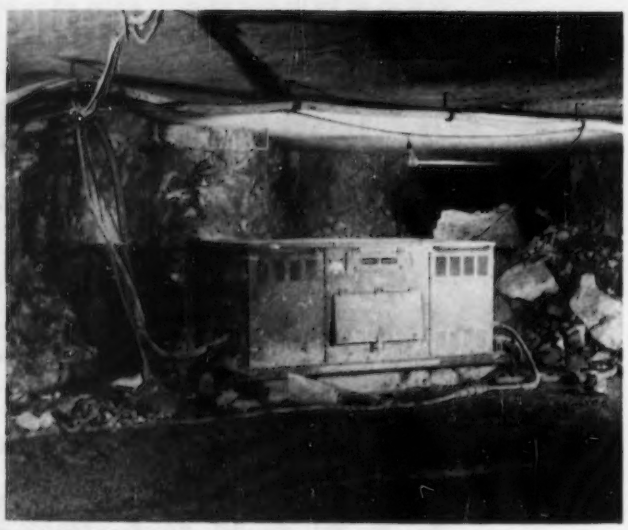




HIGH EFFICIENCY AND POWER FACTOR of General Electric synchronous conveyor or compressor motors cut electrical losses, and can reduce power rate. High and low speed types are available in many sizes, with just the required type starting, pull-in, and pull-out torque.

System-engineered raises efficiency of

CONTINUITY OF PRODUCTION and flexibility of operation are promoted by G-E metal-clad switchgear. Factory-assembled, it is easily installed and maintained.



MORE DEPENDABLE G-E a-c mine power supply, used underground, steps down voltage close to the mining load, minimizing voltage drop, increases the efficiency of your mining machines.

LOW COST CONVERSION of power is obtained with portable G-E mining-type mercury-arc rectifiers. Move easily as face advances. Absence of major rotating parts reduces wear, shutdowns.

SPECIALLY DESIGNED for service reliability, rugged G-E totally enclosed fan-cooled Tri-Clad* motors are also available in design approved by Bureau of Mines.

G-E equipment underground mining

Modern General Electric equipment can give you the speed, flexibility and safety you need for more efficient underground mining. G.E. can also help in these ways:

Latest electrical techniques are employed by G-E application engineers, working closely with you or your consultants, to give you the most flexible and lowest-cost system for your mining needs.

Extensive developmental facilities are constantly used by G-E product engineers in providing new and improved products to help you increase mining output and efficiency.

From early plans through start-up, G.E. can co-ordinate selection, delivery and installation of all your electric equipment, saving you engineering time and construction costs. For more information, contact your nearest G-E Apparatus Sales office, or write General Electric Co., Schenectady 5, N. Y. 660-33

HIGH AVAILABILITY of G-E mine locomotives cuts costs. G.E. offers a variety of types which handle easily, efficiently, and help speed all haulage in underground mines.

*Reg. trade-mark of General Electric Co.

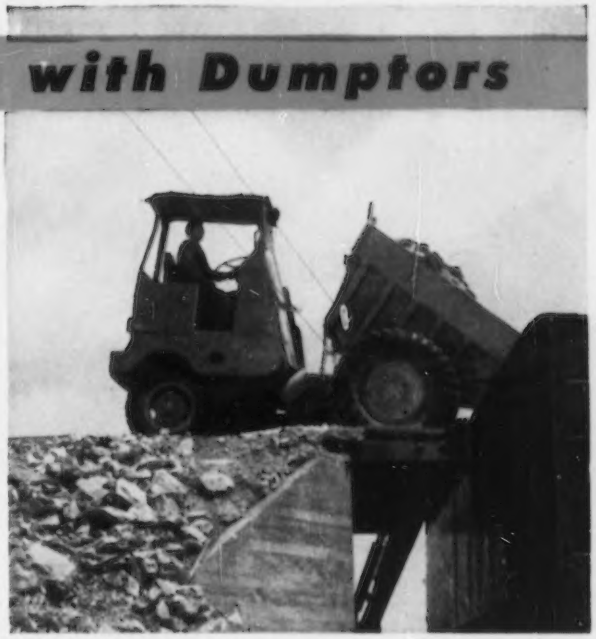
Engineered Electrical Systems for Underground Mining

GENERAL ELECTRIC

Haul underground .
KOEHRING COMPANY, Milwaukee 16, Wis.
Subsidiaries: PARSONS
KWIK-MIX • JOHNSON

. . or on the surface with Dumptors

Trackless mining — Hauling zinc ore from underground mine to railroad siding, 3 Koehring Dumptors ramp-load directly into cars. On this trackless haulage operation, the 6-yard Dumptors are loaded underground by a tractor-shovel. They travel along tunnel to an inclined haul-way, where they have an 1100-foot climb up 11½% grade to the mine entrance. Production for the 3 heavy-duty haulers has averaged 500 tons of ore a day — and the mine foreman reports that maintenance has been "almost nil". It's easy to see why. For one thing, Dumptors have no troublesome body-hoists. *Gravity* dumps the load — and gravity-dump never balks, never wears out.



14 Dumptors in one mine —

On extensive open-pit stripping to uncover lithium deposits, rocky overburden is hauled by a fleet of 14 Koehring Dumptors. They also carry ore from pit to stockpile. Excavating is handled by tractor-type loaders and power shovels. Notice how Dumptor's big square body opening and low rear entry permits fast loading over the end or sides.

Up-hill haul all the way —

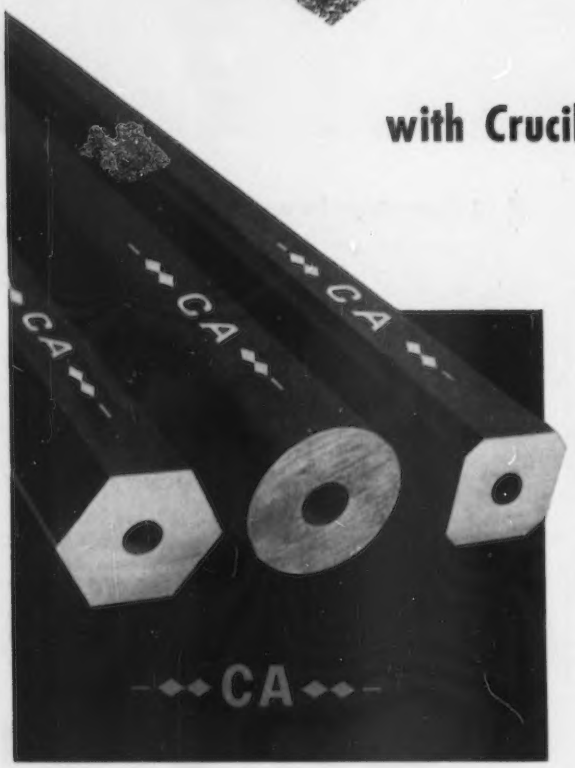
Teamed with a Koehring 1½-yard shovel, 3 Dumptors haul up steep grade out of pit, then climb ramp to dump. These off-road 6-yard Dumptors have better than 6 h.p. per ton of loaded weight. They accelerate fast, pull through soft ground, up grades with less shifting, climb 24% grades fully loaded.

Prospecting for pay dirt —

At exploratory mine in the Rocky Mountain region, Dumptor goes underground, shuttles in and out of access tunnel without turning. There's no need to turn, because Dumptor has 3-speed travel in either direction — operates with equal ease coming or going. It's as efficient underground as it is on overhead trestles, or hauling along the surface.

If your work involves hauling rock, gravel, ore and other materials under difficult conditions, let your Koehring distributor show you what this 6-yard heavy-duty Dumptor® can do for you.

Now! 300% more hole at 60% less cost...



with Crucible CA DOUBLE DIAMOND alloy hollow drill rods

That's the phenomenal results construction men are getting with Crucible's new CA DOUBLE DIAMOND alloy hollow drill rods.

These new rods actually have *three times* the drilling life of ordinary carbon rods. On one major construction job CA DOUBLE DIAMOND alloy rods averaged *630 feet per rod*. And, although they are slightly higher in price, these longer-lasting rods cut costs by 60%.

It's the *steel* that makes the difference. For CA DOUBLE DIAMOND is a tough, high-carbon, high-chromium *alloy* steel, *prescription-made* for maximum resistance to wear and abrasion. What's more, its hardness in the natural or as-rolled condition is substantially higher than carbon rods. You get a stronger rod with higher fatigue resistance.

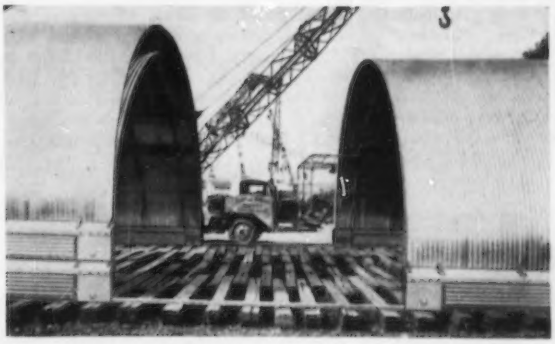
With CA DOUBLE DIAMOND, as with any alloy steel, special heat treating methods give the best results. And they'll pay off in longer rod life . . . lower drilling costs. Crucible will be glad to supply full information on CA DOUBLE DIAMOND alloy rods . . . or on its many other alloy steels for construction applications. *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

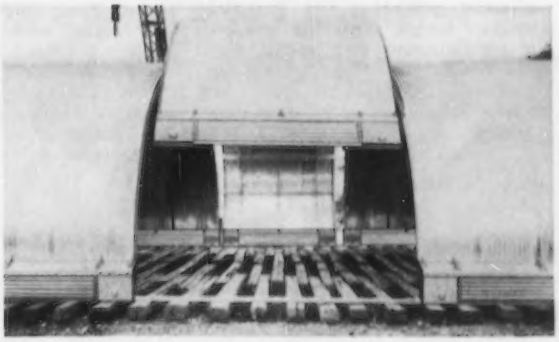
CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

E&MJ NEW PRODUCTS DIGEST

LLOYD E. ANTONIDES, Assistant Editor





SHELTERS can be mounted on wide variety of footings. For easy access, sections can be telescoped, rolled apart or raised up.

Versatile Prefab Structure Is Improved

YARD-STOR SHELTERS are a series of independent, identical sections placed side by side to form a building. Sections are made of trussed steel tubing covered with corrugated metal.

Although basic idea is to mount them on rails—one under each baseline—they can also be mounted on almost any other type of footing and even on casters. They are designed to tilt, telescope, slide apart or stack for easy access.

Each arched section is assembled from prefabricated panels. Panels are easily handled by two men and quickly bolted together to form complete shelter section. To erect, panels are simply laid out on location in logical pattern. With aid of two small A-frame windlasses, workmen bolt panels together, one at a time, as they raise completed portion toward full height. For faster construction, fully assembled sections can be purchased through new Rental Service.

Company has developed a low-bed trailer for local deliveries which will accommodate two fully assembled shelter sections. Crane, built into trailer gooseneck, swings sections into position in matter of minutes. This equipment is especially designed to fit into the company's new rental plan for emergency and temporary uses, offered through local crane and fork truck rental services.

Each of six styles has a descriptive name. Earlier models are said to be improved. Panels now come with covering welded to truss except for overseas shipments, in which case trusses, frames and covering are compactly bundled and must be bolted together prior to erecting. A new rubber seal and way to cement joint has been developed. **(1)**

Tire Changing Tool

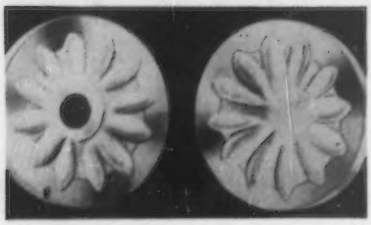
Termed an "outstanding development" in reducing costly down time for big earthmovers, TO-100 hydraulic tire changing tool is announced by Goodyear Tire & Rubber Co., Akron, Ohio. Primarily designed for their own tubeless assembly, it is said to be only portable hydraulic changer on market applicable to all types of rims. **(3)**

Geophysical Instrument

Magnetic Susceptibility Bridge MS-1 by Geophysical Specialties Co., Minneapolis, Minn., is claimed to rapidly determine magnetic properties of mineral formations. Compact, 21 lb self-contained instrument can help in correlation, in checking if contrast is sufficient for using method, and also in station spacing and instrument selection. **(2)**

Those Gremlins!

It's a good thing our offspring aren't close readers of NPD. Otherwise we and Allis-Chalmers would have been swamped by demands for more information on the 17 cu ft TW-360 Motor Wagon mentioned in Nov., especially just before Christmas. Of course everyone knew it should have been 17 cu. yd. But it took Allis-Chalmers themselves to bring it to our attention.——**L.E.A.**



Lab Grinding Plates (15)

Ceramic grinding plates for Braun laboratory sample pulverizers give even less contamination than special metal plates usually used. Made by Bico Inc., Burbank, Calif., of alumina ceramic in a special pattern, they are the result of several years' experimentation. Test by USGS gave excellent results.

Scintillation Counter (14)

Gamma Gun Model UAC 511 is a handy counter that is transistorized. Probably the most unusual feature claimed by the maker, Universal Atomics Corp., New York, N. Y., is the uranium-thorium discriminator. Well known principle of energy level difference is said to be used. It operates on flashlight batteries.

Lighting Unit (16)

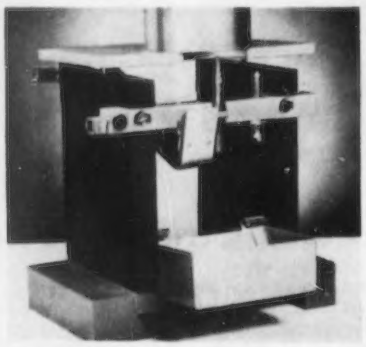
Emergency lighting unit using hermetically sealed nickel-cadmium, "lifetime" battery is offered by Dynaseal Lighting Corp., Cambridge, Mass. Claimed maintenance free, unit includes automatic charging facilities which keep battery fully charged at all times. It stays hooked up to power.

Vibratory Feeder (17)

Dust proof enclosure of magnet and leaf springs can now be furnished with F-55DT heavy duty "Vira Flow" feeder from Syntron Co., Homer City, Pa. Added feature prevents any dust in air or spillage from supply hopper to impair smooth feeding action of electromagnetic motor drive, it is claimed.

Concrete Placer (18)

Air Placement Equipment Co., Kansas City, Mo., is producing a new mobile concrete gunning rig. Unit, patterned after company's older rig, is more versatile and more completely mechanized and has greater capacity. Three basic components are: Nucretor concrete gun; Mix Elevator automatic porportioner, dry mixer and elevator; and sand loader.



Spectrograph Aid (19)

Petrey stand aids spectrum analysis of irregular shaped samples. Sample to be analyzed is placed on platform stage and electrode held below in stand. Process merely leaves charred spot on metal surface. Simple device, made by Bausch & Lomb Optical Co., Rochester, N. Y., clamps on illuminating bed of current B&L spectrographs.

Dump Trailer (20)

"Teleramic Frameless" dump trailer is announced by Anthony Co., Streator, Ill. When dumping, front end of trailer is lifted by single hydraulic cylinder mounted on tractor fifth wheel coupling. In raising or lowering, trailer body rolls and hinges on rearmost wheels while tubular stabilizer arms give added support. Weight advantage is gained.

Chain Connecting Link (22)

Page Engineering Co., Chicago, Ill., says low cost Twin-Pin connecting link is designed to make unbelievably fast and strong chain repairs. With only a hammer, they say anyone can now repair chain right on the job in 5 minutes. Unit can also be used to join load line to hitch plate extension and, in larger buckets, as connection to trunnion link.

Heavy Duty Trucks (21)

Mack Trucks Inc., New York, N. Y., says new super duty B-80 line comprises most rugged Macks of their size ever built. Gross vehicle weight rating is 46,000 lb for 4-wheelers, and 55,000 and 65,000 for 6-wheelers. They come in eleven models with choice of gasoline or diesel engines from 170 to 300 hp including 205-hp turbocharged diesel.

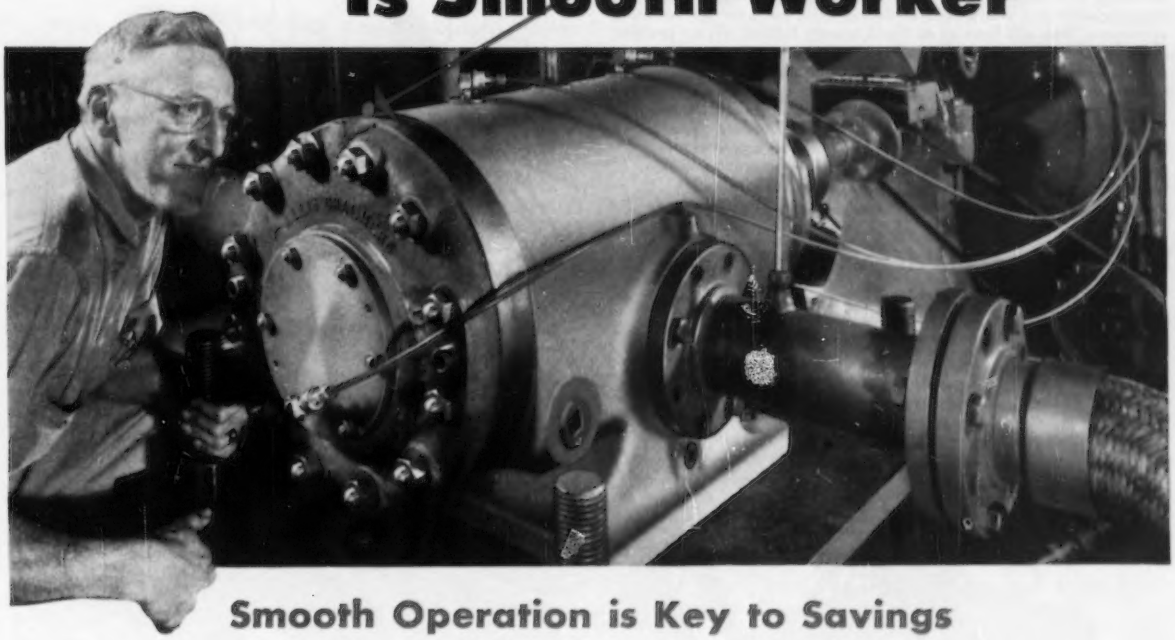
Welding Aid (23)

Porto-Magnetic plate clamp combines powerful magnetic base and screw jack. Designed to eliminate clamps, tack welds, wedges, etc., in welding, device can also be used with hoist to spot and lift plates. Contour shoes fit flat base to curved surfaces. Manufacturer is Portomag Sales, Inc., Ferndale, Mich., who also make similar magnetic drill press.

Fork Lift (24)

Dynamotive fork lift truck made by Automatic Transportation Co., Chicago, Ill., now features a LP gas engine in addition to electric model. Use of propane or butane gives almost complete combustion with little carbon, fumes and maintenance, the company pointed out. Increased engine life is claimed. Capacities are from 4,000 to 10,000 lb.

Coin Trick Proves
RO-FLO COMPRESSOR
Is Smooth Worker



Smooth Operation is Key to Savings

Everybody around the place knew the *Ro-Flo* compressor was a smooth operator. But just how smooth?

Someone suggested the old coin trick . . . balance a coin on it while it's running.

The next we knew the foreman was calling, "Come down and see for yourself." We went to the shop. And sure enough, there the penny was standing as still as you please.

What does that mean to you?

It means, here's a compressor that needs practically no foundation. And it means there's no wear and tear from vibration...less maintenance.

You get constant air supply with this machine, too. For this story: Call your nearby A-C office for complete information, or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

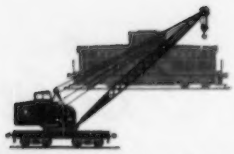
A-4716

Ro-Flo is an Allis-Chalmers trademark.

ALLIS-CHALMERS

Ro-Flo compressors provide constant efficiency and air supply for air tools

YOU BUY ONE MACHINE . . .
GET THE PERFORMANCE OF TWO



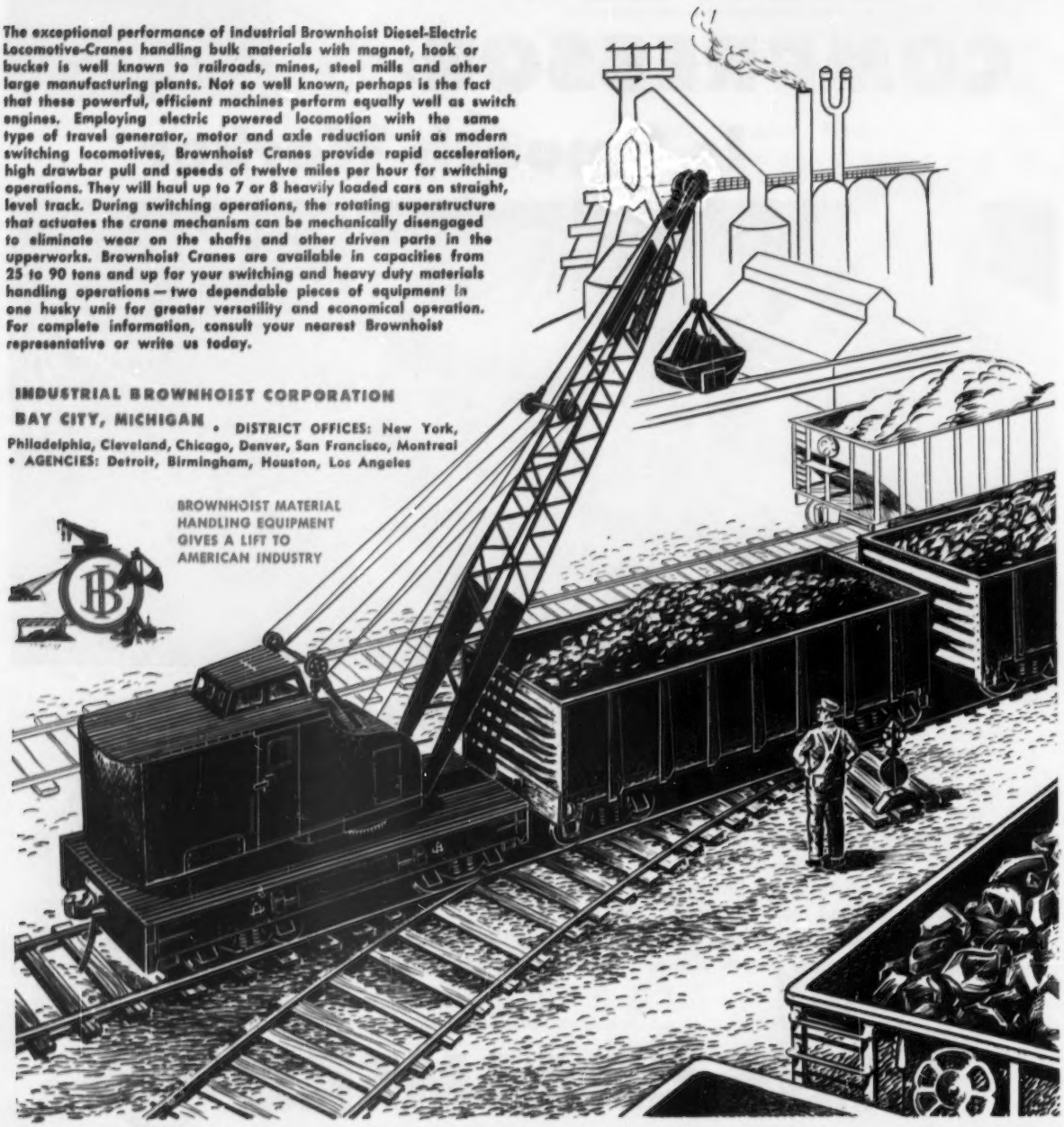
BROWNHOIST *diesel-electric locomotive-cranes double as switch engines*

The exceptional performance of Industrial Brownhoist Diesel-Electric Locomotive-Cranes handling bulk materials with magnet, hook or bucket is well known to railroads, mines, steel mills and other large manufacturing plants. Not so well known, perhaps is the fact that these powerful, efficient machines perform equally well as switch engines. Employing electric powered locomotion with the same type of travel generator, motor and axle reduction unit as modern switching locomotives, Brownhoist Cranes provide rapid acceleration, high drawbar pull and speeds of twelve miles per hour for switching operations. They will haul up to 7 or 8 heavily loaded cars on straight, level track. During switching operations, the rotating superstructure that actuates the crane mechanism can be mechanically disengaged to eliminate wear on the shafts and other driven parts in the upperworks. Brownhoist Cranes are available in capacities from 25 to 90 tons and up for your switching and heavy duty materials handling operations — two dependable pieces of equipment in one husky unit for greater versatility and economical operation. For complete information, consult your nearest Brownhoist representative or write us today.

INDUSTRIAL BROWNHOIST CORPORATION

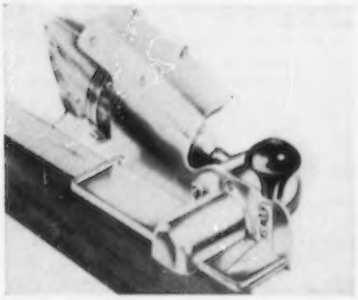
BAY CITY, MICHIGAN • **DISTRICT OFFICES:** New York, Philadelphia, Cleveland, Chicago, Denver, San Francisco, Montreal • **AGENCIES:** Detroit, Birmingham, Houston, Los Angeles

BROWNHOIST MATERIAL HANDLING EQUIPMENT GIVES A LIFT TO AMERICAN INDUSTRY



BROWNHOIST

BUILDS BETTER HEAVY DUTY MATERIALS HANDLING EQUIPMENT



Power Planer (45)

Power planer attachment for any ¼-in. portable electric drill, is reputed to cut hours off tiresome hand planing and to smoothly finish wood or plywood. It is an addition to line of portable electric tool accessories made by Alladin Mfg. Co., Kansas City, Mo. Gear driven, rotating cutter cuts 2 in. wide, ¼-in. deep. Attachment weighs 3½ lb.

Dump Trailer-Truck (46)

Earthmover truck-tractor with dump semi-trailer, called 802-B, is announced by Kenworth Motor Truck Corp., Seattle, Wash. Capacity is 32 cu yd (struck); gross combined weight, 165,000 lb. Unit is powered by 300-hp turbocharged Cummins diesel. As trailer is raised by telescopic hydraulic cylinder, rear wheels roll forward. It is designed to haul ore.

Instrument Enclosure (47)

For convenient reading of enclosed meters, gages or similar devices in hazardous location, Pyle-National Co., Chicago, Ill., has developed a series of instrument enclosures which need not be opened when taking readings. Pylets, as they are called, are explosion-proof, dust-tight and rain-tight. They have threaded covers and heavy glass windows.

Hard Surfacing (48)

Iron powder, low hydrogen, hard-surfacing welding electrodes are available from McKay Co., Pittsburgh, Pa. Hardalloy 48 is claimed to give fast, sound and crack resistant weld deposits better than conventional contact types. Least penetration for developing good bond cuts problems normally associated with base metal dilution, it is said.

Hand Lift Truck (49)

Reduction of 25% of manual effort required for hydraulic, hand lift-truck, pallet handling operations is claimed by the Yale & Towne Mfg. Co., Philadelphia, Pa., for its Model A hand truck. They say gain is effected by light weight tubular construction and increased maneuverability. It has 2,000-lb capacity and lifts through foot pedal pump.

Air Filtration Aid (50)

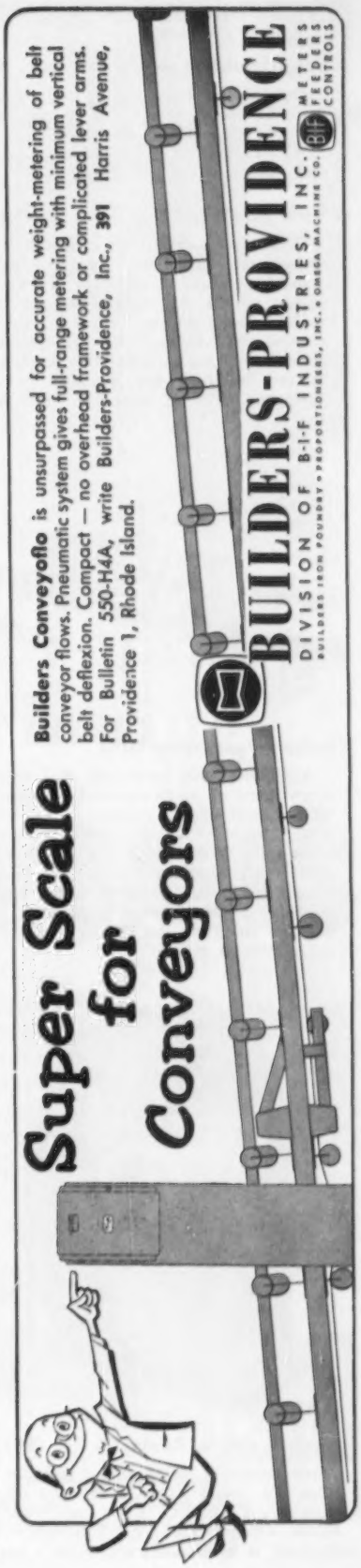
Wheelabrator Corp., Mishawaka, Ind., announces Ultra-filtration for super cleaning atmospheric air. Conventional Dustube, tubular cloth bag filters, are charged with filter aid which precoats surfaces and provides trap for fine dust and tar-like matter. Maintenance is limited to shaking and recharging, which company says is infrequent.

Transit-Level (51)

Primary designed for builders, this inexpensive convertible transit-level has new optical system, focuses down to 3 ft, reads to 5 min. C. L. Berger & Sons Inc., Boston, Mass., is manufacturer of the instrument.

Closed-Circuit TV (52)

Remote control television camera is announced by Dage Television Div., Thompson Products Inc., Michigan City, Ind. Lens changing, focusing and aiming is done from receiver console of 285-A servo system.


Super Scale
for
Conveyors
Builders Conveyoflo is unsurpassed for accurate weight-metering of belt conveyor flows. Pneumatic system gives full-range metering with minimum vertical belt deflexion. Compact — no overhead framework or complicated lever arms. For Bulletin 550-H4A, write Builders-Providence, Inc., 391 Harris Avenue, Providence 1, Rhode Island.
BUILDERS-PROVIDENCE
DIVISION OF B-I-F INDUSTRIES, INC.
METERS
FEEDERS
CONTROLS

Submersible Pump (53) ►

Verti-Line submersible booster pump has capacities from 100 to 4,000 gpm at 50- to 500-ft heads. Layne & Bowler Pump Co., Los Angeles, Calif., and General Electric joined in its design.

Fluid Analyzer (55)

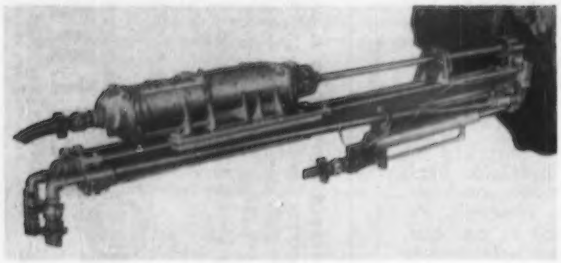
Model III Photoelectric Analyzer for automatically analyzing, recording and controlling chemical processes involving liquids, vapors or gases, is announced by Manufacturers Engineering & Equipment Corp., Hatboro, Pa. Instrument automatically compensates for smudge on cell windows and similar errors. Compact cabinet is only few cu ft in size.

◄ Tamping Pole (54)

Sections of tamping pole made by Ideal Explosives Supply Co., Asheville, N. C., are easily joined by slotted nonsparking log chain joints. Sections are 10 ft long, 1½-in. in diam.

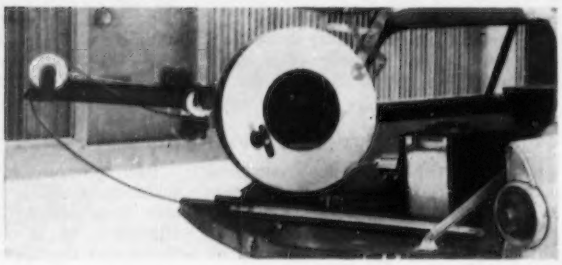
Trailer Dump (56)

Self-contained hydraulic hoist makes Model STM (SP) tandem axle trailer dump a versatile hauler. Any conventional tractor-truck can be used and loaded trailer can be unhitched and dumped as wanted. It uses 15-hp gasoline engine mounted on trailer. Galion Allsteel Body Co. Div., Hercules Galion Products Inc., Galion, Ohio, makes the 10- to 36-cu yd unit.



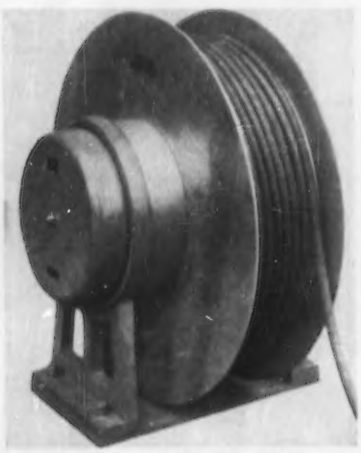
Rotary-Percussive Drill (57)

Albo DK 7 ES, hard rock drill, is said to give at least 5 times speed of 45-lb standard percussive hammer drill. Less bit and steel wear is claimed. Added to ¾- to 1½-ton screw feed thrust are 6,000 percussive blows per minute and 180 or more rpm. Weight is 255 lb, complete. Unit can use air or water flush. Made by Hausherr in Germany, machine is offered through B. J. Nykerk Corp., New York, N. Y. Feed spindle is driven by motor at front end of shell. Air consumption for complete unit, feeder and drill, is about 355 cu ft per minute at 60 psi



Radiation Logging Unit (58)

Gamma Logger is complete motor-driven scintillation counter logging unit designed for professional prospector and mining engineer. It consists of power-driven reel and extending arm, adjustable pitch metering pulley which drives footage counter and radiation level graphic recorder, and stainless steel counter probe. Unit can be mounted rigidly (e.g. on drill rig) or supplied with portable base for vehicular use. Weight is less than 160 lb with 1,500 ft of cable. Made by Moran Instrument Corp., Pasadena, Calif., it is claimed to be accurate in most severe service and to have many technical features.

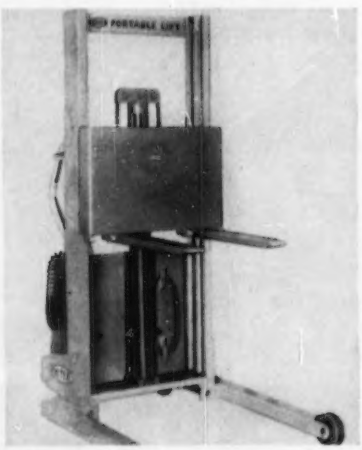


Electric Cable Reels (59)

Mechanism in spring loaded reels for large size electric cable is designed for most rugged mine and quarry use. Power House Components Ltd., Nottingham, England, is manufacturer.

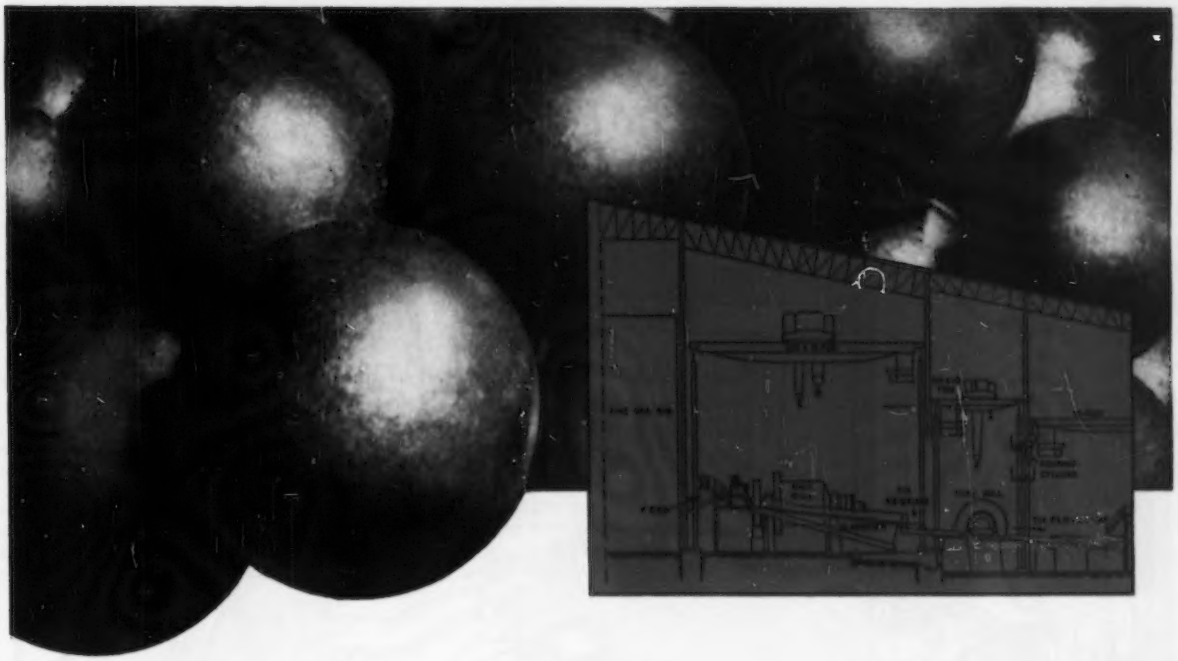
Air Driven Floodlight (60)

Explosion-proof floodlight powered by compressed air turbo-generators and cooled by exhaust air is made by Atlas Copco Eastern Ltd., Paterson, N. J. TGB 41 is 150-watt, draws 23 cu ft air.



Lift Truck (61)

One man, 2,000-lb, manually propelled, hand or battery-powered hydraulic lift is part of new line by the Oster Mfg. Co., Cleveland, Ohio. Built-in charger is on battery model.



for superior resistance to abrasion and impact in wet grinding...

CF&I GRINDING BALLS

You'll find that CF&I Grinding Balls are ideal for most types of wet grinding because they combine excellent resistance to both abrasion and impact. Because of this combination of properties, they can be used economically in wet grinding mills, operating at high or low speeds, with either high or low pulp concentrations.

CF&I Grinding Balls give this superior service because they are forged from special analysis steel. Since they are free of surface imperfections, CF&I Grinding Balls wear evenly. Further, each ball is carefully inspected throughout production and immediately before shipment to make certain that it has no surface pits, circumferential ridges or other surface unevenness.

CF&I Grinding Balls are available in diameters from ¾" to 5". For full details, get in touch with your nearest CF&I Sales Representative.

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Rock Bolts • Grinding Rods
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3784

Down time is no joke.

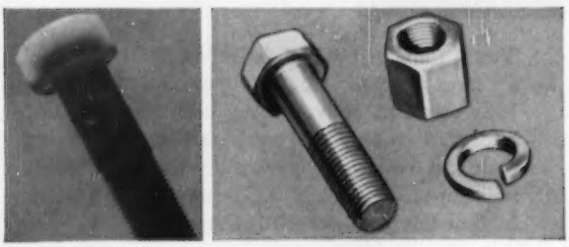
But it happens at times when track hardware gives out.

If you replace with original Caterpillar hardware, here's what you're sure of: bolts, nuts, capscrews and lock washers made from prechecked fine-grade steels, carefully hardened and tested, finished to the strictest specifications in the industry. You're sure of longer wear life, no matter how tough your jobs come. You're sure of *less* down time in the future.

If you replace with substitute hardware—can you be sure of anything?

Better get Caterpillar parts every time.

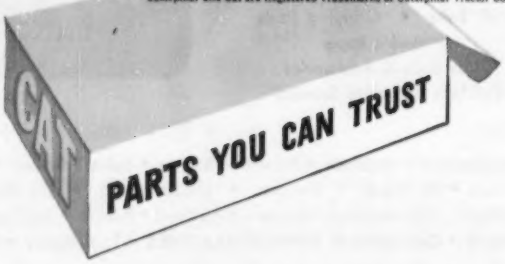
Caterpillar Tractor Co., Peoria, Illinois, U.S.A.



On the surface, CAT hardware looks like ordinary kind. But etched cross section of newly designed track bolt (left) shows depth of special "Hi-Electro" hardening penetration in bolt head.*

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.



NEW PRODUCTS DIGEST *(Continued)*

Concrete Form Coating (62)

Stonhard form coating is a brown liquid resin. Stonhard Co., Philadelphia, Pa., says it is moderately priced and meets demand for coating that will not be "all soaked up" by wood forms or "drain away" on metal forms. Solid surface film is produced which is reported to eliminate all sticking. Color shows missed areas.

Welding Electrode (64)

All-position, iron powder-type welding electrode is announced by Lincoln Electric Co., Cleveland, Ohio. Called "Improved Fleetweld 47," it is claimed to have ease of operation and higher speed advantages of iron powder electrode without restriction to downhand use. It is designed for high speed welding of mild steel with ac or dc.

Incandescent Lamp (63)

Claimed as "greatest single improvement in incandescent light bulb performance in 42 years," new lamps by General Electric Co., Cleveland, Ohio, are now available in 750- and 1,000-watt sizes. Smaller sizes are to come. Light output and life are increased, it is said, by lengthwise positioning of coiled-coil filaments.

Screen Suspension (65)

For their larger screens, Pioneer Engineering Works Inc., Minneapolis, Minn., has an optional secondary spring suspension designed to eliminate transfer of vibration, increase freedom of screen motion and reduce strain on moving and structural parts. Four heavy coil springs, one on each corner, carry entire weight of screen and frame.

For Your Files

This informative manufacturers' literature is free unless otherwise specified. To obtain bulletins circle their numbers on card below and mail.

WIRE ROPE SLING wall chart from American Chain & Cable Co. Inc., Bridgeport, Conn., shows their slings, gives capacity and gives rope diameters. It is meant for hanging in rigging departments or on hoists. It's in three colors. **(66)**

BASIC ENGINEERING DATA, though leaning toward highway and heavy construction, is presented in pocket book called "Facts and Figures." Published by Pioneer Engineering Works Inc., Minneapolis, Minn., this tenth edition is up to date. **(67)**

POWER PUMP installation and care is well covered in a 20-page booklet offered by Worthington Corp., Harrison, N. J. Profusely illustrated with frames from their colored sound slidefilm on the subject, it gives fundamentals. **(68)**

ALLOY STEELS is title of 32-page publication issued by Sheffield Steel Div., Armco Steel Corp., Houston, Texas. It contains a "to-the-point" rundown on properties that alloying elements impart and descriptions of their steels. **(69)**

RADIATION SURVEYING is given a fast treatment in booklet entitled "64 Questions and Answers on Geiger Counters and Scintillators" available from Precision Radiation Instruments Inc., Los Angeles, Calif. It's written in layman's terms. **(70)**

LP GAS story is told in non-technical manner in brochure "LP Gas, the Cinderella Fuel" by Gulf Oil Corp., Pittsburgh, Pa. Fast growing use of fuel has prompted them to tell what it is, how it is produced and how it is distributed. **(71)**

PATENT ABSTRACT SERVICE offered by Picturesort Co., New Haven, Conn., is based on a punched card system. Brief description of patent is given on card. Weekly abstracts are given for group specified. Bulletin is available on it. **(72)**

MADE-TO-ORDER METALS in experimental quantities are available through production and processing service of Allied Products Div., Hamilton Watch Co., Lancaster, Pa. Illustrated "slim-jim" booklet describes facilities. **(73)**

ENGINEERING SERVICES are described in a booklet titled "A Guide for Selecting an Engineering Firm." Prepared by the Teller Co., Butler, Pa., for helping top management, it explains difference in installation, project and design firms. **(74)**

CONVEYOR magazine published by Stephens-Adamson Mfg. Co., Aurora, Ill., covers materials handling around the world. Several interesting types are shown in Volume 214. Most interesting is dust tight Zipper belt installation. **(75)**

SAFETY is subject of magazine put out by Mine Safety Appliances Co., Pittsburgh, Pa. Called "MSA Safety Progress" it gives case histories of good safety programs. Among topics in latest issue are gas detection, ventilation and hard hats. **(76)**

JAN. 1956

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Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled.

1	15	29	43	57	71	85
2	16	30	44	58	72	86
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4	18	32	46	60	74	88
5	19	33	47	61	75	89
6	20	34	48	62	76	90
7	21	35	49	63	77	91
8	22	36	50	64	78	92
9	23	37	51	65	79	93
10	24	38	52	66	80	94
11	25	39	53	67	81	95
12	26	40	54	68	82	96
13	27	41	55	69	83	97
14	28	42	56	70	84	98

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NEW PRODUCTS DIGEST *(Continued)*

COMMUNICATIONS case histories where company-owned telephone systems proved economical are described in a series of brochures that may be obtained from Automatic Electric Sales Corp., Chicago, Ill. They make P-A-X system. **(77)**

BALANCING improves performance of machinery by reducing wear and failures, noise and vibration and maintenance. Dy-Namic Balancing is Bear Mfg. Co.'s scheme. The Rock Island, Ill., company has a booklet explaining it. **(78)**

NICKEL-PLATED STEEL is good protection against contamination and corrosion. Bart lectro-clad, available from Colorado Fuel & Iron Corp., N. Y., is technically described in manual. Fabrication is explained too. **(79)**

CENTRALIZED LUBRICATION promises considerable savings according to Farval Corp., Cleveland, Ohio. In a recent bulletin, "Studies in Centralized Lubrication 1955," they give several case histories of applications. **(80)**

MULTIPLE V-BELT DRIVE Engineering Standards are presented in a manual from Multiple V-Belt Drive & Mechanical Power Transmission Assoc., Chicago, Ill., and Rubber Mfgs. Assoc., New York, N. Y. It gives basic design data. **(81)**

CORROSION CONTROL using cathodic protection systems offered by Harco Corp., Cleveland, Ohio, are described in technical brochure just released. Case histories are used to prove their point that such systems save money. **(82)**

SOLID-LIQUID SEPARATION equipment offered by Hardinge Co. Inc., York, Pa., is comprehensively described in a new catalog. Thickeners, clarifiers and agitators are covered. Applications are discussed and selection methods are given. **(83)**

BELT CONVEYOR idlers, trippers and some accessories are cataloged by Stephens-Adamson Mfg. Co., Aurora, Ill., in a new bulletin. A wide variety is offered. A number of proven applications are used for illustration. **(84)**

HYDRAULIC EQUIPMENT line offerred by New York Air Brake Co., New York, N. Y., is shown in a 16-page color general brochure. It is intended as a quick guide to the full line of pumps, motors, controls and accessories produced by 5 divisions of the company. **(85)**

HOSE is the topic covered in two recent data sheets available from B. F. Goodrich Co., Industrial Products Div., Akron, Ohio. One is on couplings; the other on various types of water hose. They are concise and illustrated. **(86 & 87)**

BUCKET ELEVATOR chains and drive wheels may by Beaumont Birch Co., Philadelphia, Pa., are detailed in a catalog. The company guarantees they will perform at less cost per ton than any conventional design chain manufactured. **(88)**

WIRE ROPE FITTINGS of Sauerman Bros. Inc., Bellwood, Ill., are shown in a concise bulletin. Use of each type is explained. A companion bulletin and sheet describe their Durolite wire rope blocks. **(89)**

HARDSURFACING ALLOYS offered by Coast Metals Inc., Little Ferry, N. J., are presented in a set of data sheets now available. Various applications as well as composition and technical information, are given. **(90)**

WELDING MACHINES made by Hobart Brothers Co., Troy, Ohio, are shown in a catalog-type release. Each is illustrated with photo. Both electric motor driven welders and gasoline engine ones are shown, along with accessories. **(91)**

STEEL JOISTS of open web design are concisely but thoroughly covered in a bulletin from Joseph T. Ryerson & Son Inc., Chicago, Ill. Economics of lightweight design are explained. Design and installation data are given. **(92)**

HEAT EXCHANGERS for all plating, pickling and anodizing solutions are specified in release from Carl Buck & Associates, Essex Fells, N. J. Trade name is Carmac. Selection chart covers materials needed for various solutions. **(93)**

WHEELED TRACTOR-LOADERS offered by Contractors Machinery Co. Inc., Batavia, N. Y., under trade name of Trojan Loadster, are described in a series of information sheets and booklets. Versatile attachments are also shown. **(94)**

CRUSHING PLANTS based on Type "J" jaw crusher are presented in a bulletin from Denver Equipment Co., Denver, Colo. Both portable and semi-portable units are shown. Average capacities of each are given in table. **(95)**

VIBRATING SCREENS available from Pioneer Engineering Works, Inc., Minneapolis, Minn., are described in bulletin. Descriptions include field photos of applications and tables of capacities. This Super Service line is for heavy duty. **(96)**

VACUUM DEGASSER for purifying molten metals, made by Kinney Mfg. Div., New York Air Brake Co., Boston, Mass., is described in bulletin. Compact unit is said to offer many advantages to foundry operators. **(97)**

HEAT AND POWER BOILER selection guide is handy in catalog issued by Koehring-Waterous Ltd., Brantford, Ontario. Publication covers their line of units. It is well illustrated and gives complete information. **(98)**

(PLEASE GIVE THIS ADVERTISEMENT TO YOUR BLASTING FOREMAN)

Laying the "groundwork" for profitable blasting

He's laying the main (trunk) line of Primacord to connect all holes in a hook-up which will permit relief of burden — develop better fragmentation with less secondary blasting. Holes have been loaded and tamped. A "down" line of Primacord extends from top to bottom of each hole, in contact with all explosives in the load, detonating directly or initiating a primer — depending upon the type of explosive used.

When the trunk line has been laid, he'll cut it from the spool — then connect each "down" line at right angles to the trunk line with the simple half-hitch which has been found most effective for the type of Primacord used in the holes.

When all is ready for the blast, he'll prepare his fuse and cap (or use an electric blasting cap) and tape this cap onto the firing end of his Primacord hook-up.

Primacord is an insensitive detonating fuse. It cannot be set off by fire, friction or ordinary shock, but must be detonated. It is not affected by stray currents, and even a direct hit by lightning failed to detonate it.

For more information see your Explosives Supplier, or write to

THE ENSIGN-BICKFORD COMPANY
Simsbury, Connecticut

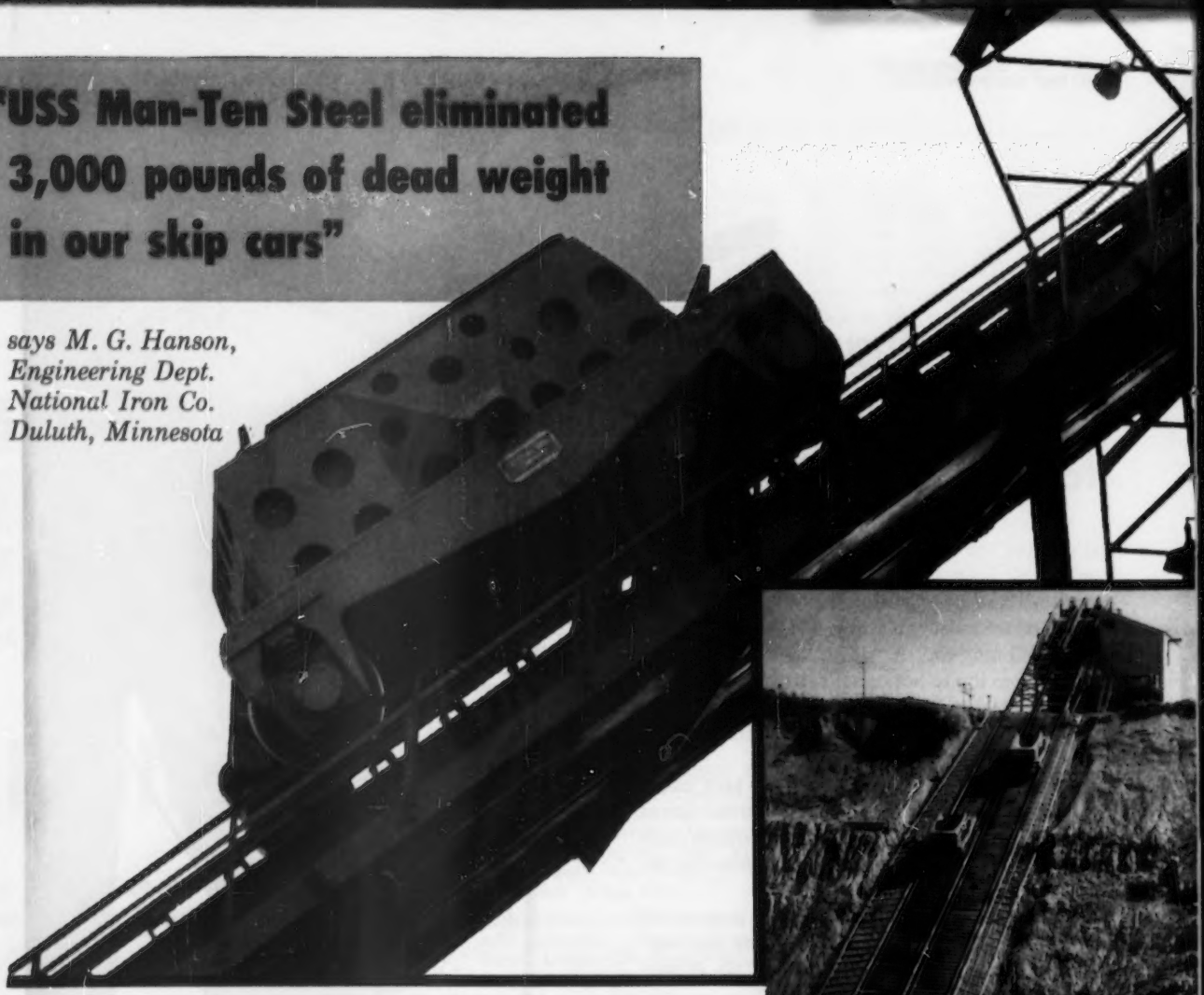
Primacord • Quarrycord • Ignitacord® • Safety Fuse Blasting Accessories • Established 1836

PRIMACORD®

The Proved and Approved DETONATING FUSE

"USS Man-Ten Steel eliminated 3,000 pounds of dead weight in our skip cars"

says M. G. Hanson,
Engineering Dept.
National Iron Co.
Duluth, Minnesota



Rockover Skip Cars have to be tough, durable and as light as possible. They run up and down steep inclines almost continually. And because they're dump-type cars they have to resist abrasion.

"Cut down the weight of skip cars," says Mr. Hanson, "and they move faster, carry bigger payloads and require smaller, less expensive hoisting equipment. We accomplished all these things by using USS MAN-TEN Steel in our skips. Because this steel is extra strong we are able to use it in thinner sections to reduce weight, and at the same time maintain the high strength required of our heavy duty cars.

"Here are three reasons why we used USS MAN-TEN in our skip cars: it's easy to work, it's easy to weld, and it resists corrosion."

An accident proved why Man-Ten is best.

One day when a loaded car was halfway up the incline the power failed. Because the brake arrangement had not been set for automatic emergency operation the loaded car crashed to the bottom, and the empty car, used to help counterbalance the load, sailed over the top of the incline and landed 300 feet away. What happened? The loaded car suffered only a bent frame and was returned to service immediately. The empty skip was bent and distorted, but there was no breakage. After being straightened in the repair shop it too was returned to service.

United States Steel produces three different grades of USS High Strength Steel—COR-TEN, MAN-TEN and TRI-TEN—each having distinctive characteristics and each recommended for certain end uses where its specific properties will assure longer service and greater over-all economy. All three grades have a yield point 50% higher than carbon steel and all offer properties which allow greater strength and toughness to be built into the vital parts of machinery, equipment and structures most prone to failure.

In the mining industry these steels can be used to replace carbon steel in the vital parts of mine cars, dozers, shovels, draglines and other such equipment to increase service life without increasing dead weight. And if the use of thinner sections is possible, they can (1) reduce equipment weight without reducing its strength, or (2) increase the size and capacity of equipment without increasing the total weight or the power needed to move it.

For more information, write or call our nearest office.

UNITED STATES STEEL CORPORATION, PITTSBURGH • AMERICAN STEEL & WIRE DIVISION, CLEVELAND • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
NATIONAL TUBE DIVISION, PITTSBURGH • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. • UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
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USS HIGH STRENGTH STEELS

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Longyear

Longyear core drills are on the move - everywhere!

... by oxen team

... by Jeep

... by truck

... by itself

SPECIFICATIONS

Bulletin No. 96

extra copies available on request

FRAME-MOUNTED MODELS	CAPACITY FEET OF ROD	DIAMETER, INCHES		POWER	MOUNTING
		Hole	Core	G-Gasoline, D-Diesel E-Electric, A-Air	S—Skid-Frame, J—Jeep T—Trailer, TR—Truck
Porta	200 XRT	1 3/16	¾	G	S
Prospector	325 EW	1½	⅞	G, E	S, J, T
Longyear "24"	750 EW	1½	⅞	G, D, E, A	S, J, T
Junior	1350 EW	1½	⅞	G, D, E, A	S, T, Tr
Longyear "44" Standard	3000 AW	1⅞	1⅛	G, D, E, A	S, T, Tr
Longyear "44" Heavy Duty	4000 AW	1⅞	1⅛	G, D, E, A	S, T, Tr

E. J. Longyear Co. MINNEAPOLIS, MINN. · CABLE LONGCO

CANADIAN LONGYEAR LTD., NORTH BAY, ONTARIO • LONGYEAR ET CIE., PARIS, FRANCE

Many Users Say This Belt Outlasts Them ALL In Hard Rock Mining

The Ray-Man Conveyor Belt features a new and different construction of covers and strength member to resist cuts, tears and abrasion to a degree never before attained. R/M's exclusive "XDC" Cover provides a degree of protection and long life not possible with any other belt. Inside this cover, Ray-Man Conveyor Belt combines elastic cushioned strength member plies in an envelope of strong, yet flexible synthetic fabric to resist gouging and tearing ... to take the impact of large, abrasive lumps... to permit the belt to trough easily and train naturally.

Like all Manhattan heavy duty conveyor belts, Ray-Man is moisture resistant and mildew-proof. It requires no breaker strip and holds fasteners considerably better than other types of belts. Let an R/M representative show you the advantages of Ray-Man as well as other R/M conveyor belts, including Homocord, with its extra cushion for unusually abusive shock loading. He'll help you select the belt best suited for your job . . . one designed to give you "More Use per Dollar." Write for Bulletins 6906 and 6915.

RM-600M

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings Asbestos Textiles • Packings • Engineered Plastic, and Sintered Metal Products • Laundry Pads and Covers • Bowling Balls

"Our TD-14A DROTT rips out CONCRETE SLAB and FOOTINGS a ¾-yard power shovel couldn't touch"

—Pangia Construction Company, Atco, New Jersey

Smack 8-inch-thick slab, or 5-foot-deep footings, of pipe-laced concrete with the 17,000-pound break-out force of an International Drott TD-14A. And something's got to give!

The pictures tell you what gives as this TD-14A Skid-Shovel, owned by Pangia Construction Company, Atco, New Jersey, slams through a 150-cubic yard concrete excavation job—for a new Sinclair station in Camden.

"We are ripping out concrete slab and footings that a ¾-yard power shovel couldn't touch," reports Owner Albert J. Pangia. "The operation is fast because of the breakout action. We use our TD-14A Drott Skid-Shovel for everything."

● Why not size-up these big advantages that give you new loader job range, yardage capacity, and profit opportunities? See your International Drott distributor for a Skid-Shovel or Four-In-One demonstration!

No other loader has it!

Apply the scientific lever principle of *exclusive and patented pry-over-shoe break-out, plus ground-level bucket roll-back.* And an International Drott Skid-Shovel gives you up to three times as much concrete-smashing, frost-breaking, boulder-bucking break-out force as other front-end loaders can deliver. *No other loader even has skid-shoes!*

This great hydraulic pry-out power over big skid-shoes shunts stresses directly into the ground, too —so they can't maul bucket or tractor.

And only an International Drott has the shock-swallowing protection of patented Hydro-Spring—that reduces the effects of carrying, dumping, or other impact forces to *operator* and *tractor* by 67 per cent, or more—increases equipment life by a reported 25 per cent. *Hydro-Spring also eliminates most hydraulic hose failures!*

INTERNATIONAL HARVESTER

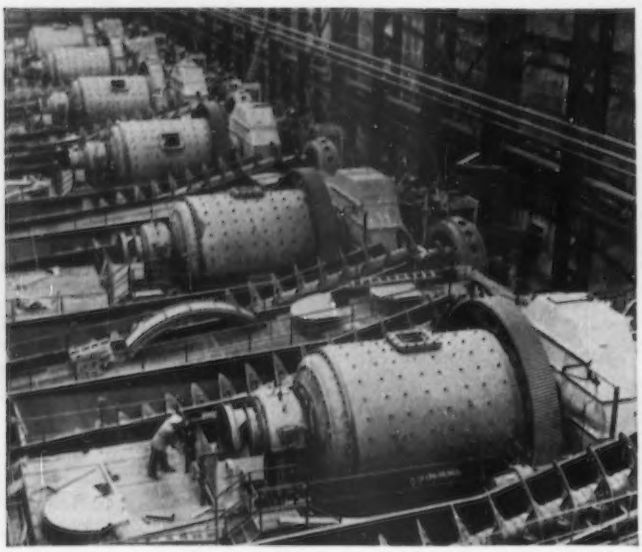
INTERNATIONAL® DROTT

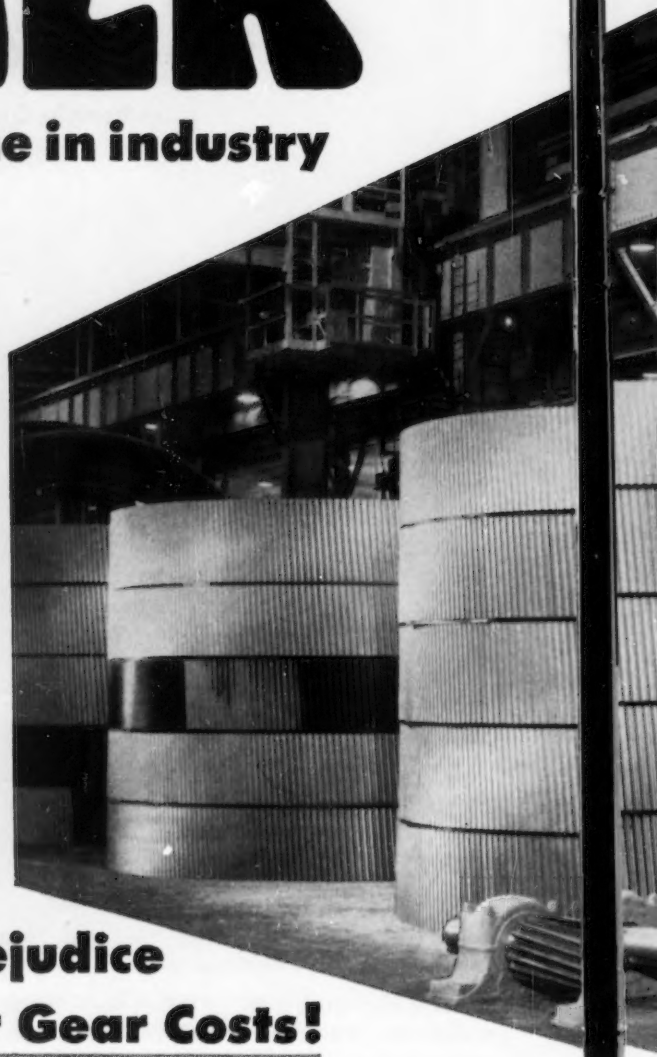
Gears by FALK

...a good name in industry

RIGHT: Single helical ring gears being prepared for shipment.

BELOW: Battery of six ball mills pulverizing copper ore. Mills are driven by 1250 hp motors through Falk single helical ring gears.





Falk's Freedom from Prejudice Can Cut Your Gear Costs!

It is false economy to use spur gears on applications which need modern helical gears. Further, it is a mistake to use a *double* (herringbone) helical where a *single* helical will serve more satisfactorily—or vice versa!

You'll find it *good business* to consult Falk—long-recognized leader in precision gear development—on your gear needs. For Falk is best equipped to recommend and produce the proper gear for any requirement—single or double helical, or spur—without prejudice! This freedom from bias is your assurance of getting the exact gear you need—and getting the maximum return from your gear investment.

Operators and engineers know that precision-cut Falk Helical Gears (with two or more helical-cut teeth sharing the load at every instant) last longer, are less subject to destructive damage from ever-present abrasives than gears of any other type. Helicals wear *in*, instead of wearing *out!* Because of their higher possible ratios, helical gears permit use of higher-speed motors.

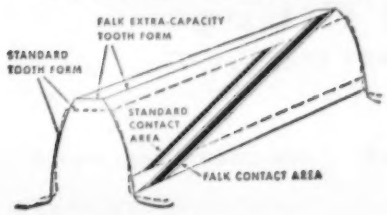
All this adds up to substantial savings: Your long-range gear costs are less because helicals last longer ...you save on maintenance, prime-mover costs, power bills and floor space. Because power transmission is smoother, driving and driven machinery performs better, has longer life.

Consult the Falk representative nearest you for complete information...also, ***write for Report 6170,*** "Advantages of Helical Gearing."

THE FALK CORPORATION ... 3001 W. CANAL ST., MILWAUKEE 8, WISCONSIN

GEAR FACTS FOR ENGINEERS

One factor determining gear rating is the amount of contact area (length and width) on teeth when engaged. With spur gears, the contact area is a narrow band, parallel with the axis of a single tooth. With helical gears, total contact area is the sum of the oblique contacts over the face of two or more teeth. Thus helical gears have substantially greater capacity than spur gears.



The Falk Helical Gears offer a special extra-capacity tooth form. The extra capacity is obtained by cutting deeper teeth that are broader at the base than ordinary helical tooth forms. This results in the larger contact area and stronger tooth shown in the sketch. Years of laboratory tests and thousands of actual field installations have proved conclusively that the exclusive tooth form of Falk single helical and herringbone gears provides substantially superior load-carrying capacity.

IDENTIFICATION DISC: An aluminum marking plate on all Walworth No. 225P's facilitates inventory control and makes reordering quick and positive.

take a good look at the Walworth "500 Brinell" no. 225P Globe

NEWLY DESIGNED HANDWHEEL: Patented air-cooled, finger-fit handwheel affords sure grip even with greasy gloves.

– the Toughest Bronze Valve Your Money Can Buy

The stainless steel, corrosion resistant seats and discs are heat treated to a hardness of 500 Brinell – hard enough to scratch glass and crush nails! The valve can be closed on sand, slag, and pipe scale without injury to the seating surfaces. "Wire drawing" is practically eliminated. All parts are accurately machined and gaged. Years of tight, positive shut-off are assured.

Available in both globe and angle types (angle type: No. 227P) in sizes ¼" to 2", this quality valve is recommended for 350 lbs. W.S.P. at 550 F, and 1000 lbs. non-shock service on cold water, oil, gas, or air.

For full data on this long-life, economical Walworth Bronze Valve, see your local Walworth distributor, or write for Circular.

IMPROVED PACKING: Molded packing of lubricated asbestos reinforced with copper wire. Suitable for practically every service. Valves can be repacked under pressure when fully opened.

note these 7 Great Features

HEXAGONAL UNION BONNET CONNECTION: Union bonnet connection eliminates any chance of distortion or leakage even though valve is repeatedly taken apart and reassembled.

OVERSIZE STEM: The high-tensile strength silicon-bronze stem assures long life and protection against wear.

SEATS AND DISCS: Plug type seats and discs of stainless steel, heat-treated to 500 Brinell hardness and machined simultaneously to a mirror-like finish, with accurate tapers assures tight positive shut-off with minimum handwheel effort.

EXTRA STRONG BODY: Made of Composition M (ASTM B61) bronze. Thick walls and rugged hexes provide a high safety factor. Valves undergo hydrostatic shell test of 1,200 psi.

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valves and fittings

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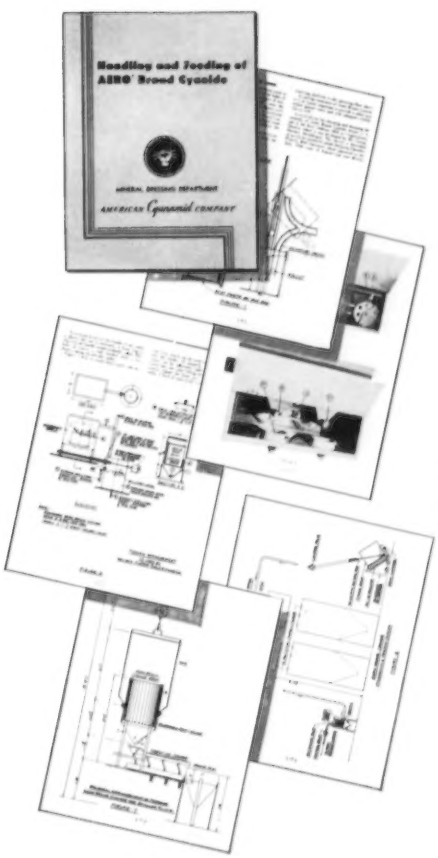
Cyanamid REAGENT NEWS

"ore-dressing ideas you can use"

Have You Received Your Copy of "Mineral Dressing Notes" No. 22



The latest issue of "Mineral Dressing Notes" was published during 1955 and is entitled "Handling and Feeding of AERO® Brand Cyanide". If you have not yet received this valuable bulletin, may we suggest that you drop us a note requesting one or use the handy coupon below.

Sections in this valuable primer on the feeding of AERO Brand Cyanide include notes on the properties of this widely used product, transportation, storage, safety precautions, and a description of the various feeding arrangements used at a number of cyanidation operations.

AMERICAN CYANAMID COMPANY
Mineral Dressing Department
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M D Notes No. 22

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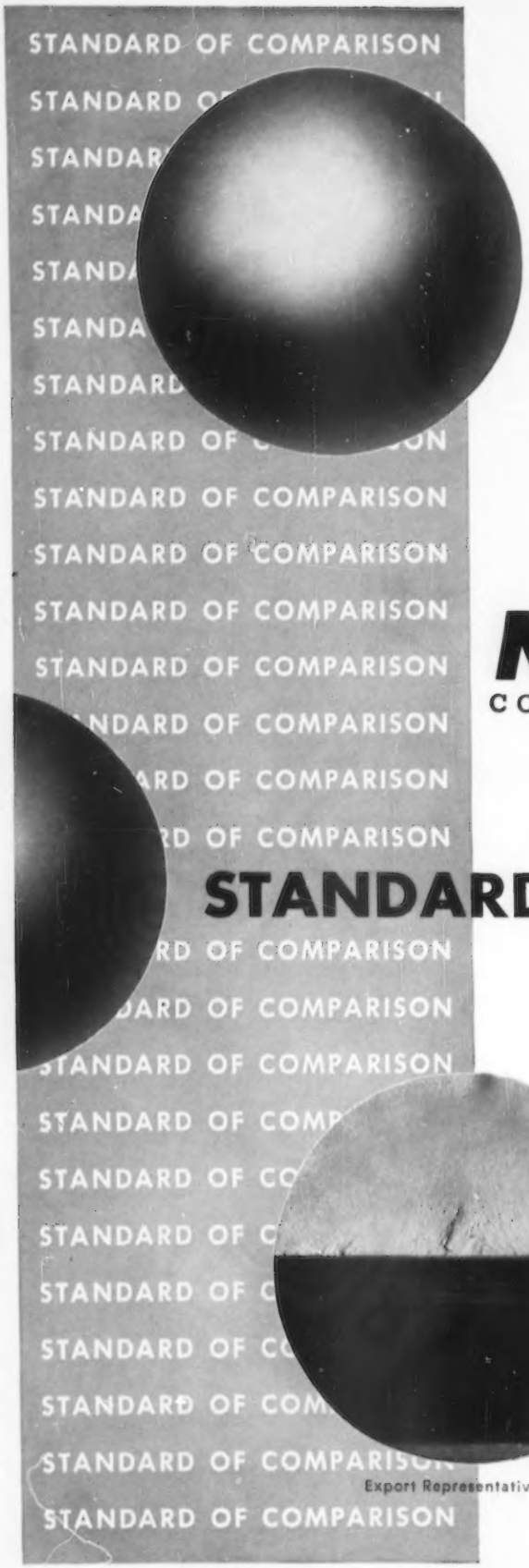

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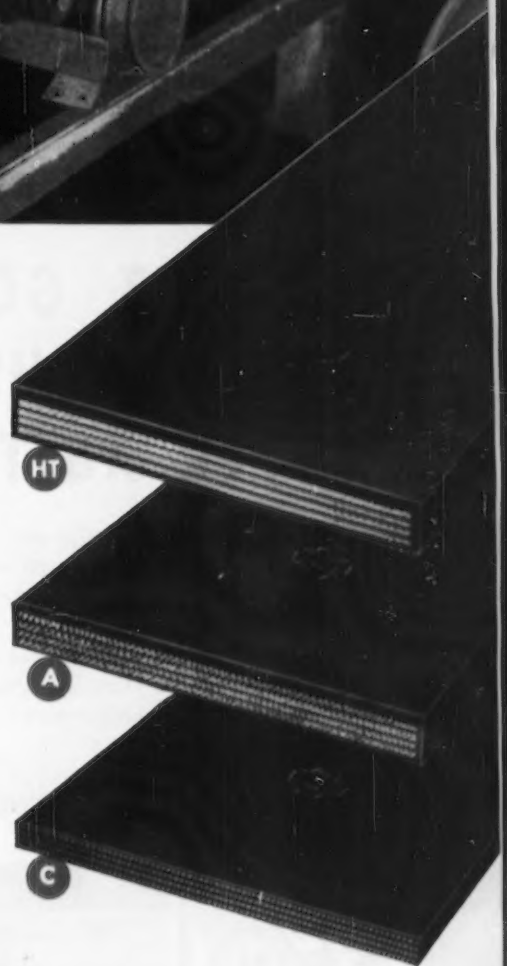
Thermoid Conveyor Belting cuts handling costs on rugged mining jobs

There's a Thermoid Conveyor Belt designed to lower your handling costs on every mining job. Here are three examples: HT —For extremely abrasive materials such as coal, granite, trap rock, flint rock, quartz ore; A —For slag, lime rock, crushed stone and other highly abrasive materials; C —For moderate abrasives such as sand, loam, soda, gravel.

Thermoid's exclusive impregnation process welds carcass and cover into an exceptionally strong, durable belt. Finest quality reinforcement and specially compounded rubber stocks assure long life . . . lower your handling costs per ton. Your Thermoid Distributor carries a complete line of Thermoid Conveyor Belting, Multi-V Belts and Hose to meet the most severe requirements of any mining operation. Call him or write direct for full information.



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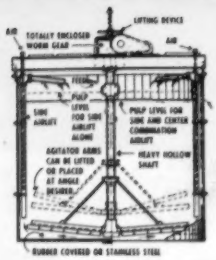
DENVER AGITATORS are STANDARD for LEACHING

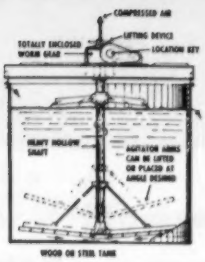
Stainless steel tanks for Denver Agitators made in Canada enroute to Sherritt Gordon Mines Limited.

SHERRITT GORDON MINES, LTD. USES 28 DENVER AGITATORS

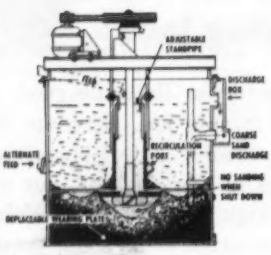
Sherritt Gordon uses 2 propeller type and 4 rake type DENVER Agitators at their Lynn Lake Concentrator and 16 propeller type and 6 rake type DENVER Agitators at their Fort Saskatchewan Refinery.

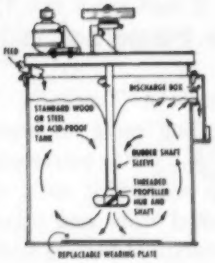
ALSO—There are 24 No. 30 (56 x 56) and 112 No. 24 (43 x 43) DENVER "Sub-A" Flotation Cells at Lynn Lake Concentrator producing nickel and copper concentrates.


LIFTING DEVICE
AIR
TOTALLY ENCLOSED WORM GEAR
FEED
PULP LEVEL FOR SIDE AIRLIFT ALONE
SIDE AIRLIFT
PULP LEVEL FOR SIDE AND CENTER COMBINATION AIRLIFT
AGITATOR ARMS CAN BE LIFTED OR PLACED AT ANGLE DESIRED
HEAVY HOLLOW SHAFT
RUBBER COVERED OR STAINLESS STEEL



Denver Side and Center Air-Lift Agitators showing method of pulp recirculation. Note many features that give trouble-free operation.





Denver propeller type agitators meet many needs for conditioning, scrubbing or leaching. Threaded propeller hub and shaft make replacement quick and low-cost.

SPECIFY DENVER for DEPENDABLE 24-Hour Service

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YOU'LL GET A LOT MORE MILEAGE with Roeprene Mine Locomotive Cable... long-run dollar savings that can't be otherwise obtained. The tough Roeprene outer jacket of this cable, cured under lead, resists severe abrasion and cutting. Acids, oils and alkalis do not affect it.

For top flexibility and longest flex life the tinned copper conductor is formed into rope strands. What's more, the conductor is insulated with a rubber compound that has high resistance to heat and moisture... woven cotton reinforcing is imbedded in the insulation and jacket to bond the cable into a compact, cohesive unit.

Order Roeprene Mine Locomotive Cable from your mining distributor... see for yourself how it boosts mileage and cuts replacements.

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MAGNETORQUE* and ELECTRONIC the only modern

These revolutionary advances in design and performance of electric shovels are just two of the reasons why operators and owners are pointing to P & H for their outstanding achievement in electric shovels . . . why P & H now is at the head of the Big Three . . . why P & H can promise you the only modern electric shovel.

Just think! Power transmission *without friction's* in massive electric shovels. Boosts efficiency. Cuts maintenance and operating costs. *This is Magnetorque.* Exclusive with P & H.

Just think! Complete control of dig, hoist, swing and propel of these giants with simple stepless control. 12% faster cycles; 16% savings in operating time. *This is Electronic Control.* Exclusive with P & H.

For complete information, call your P & H representative. Electric Shovel Division, Harnischfeger Corporation, Milwaukee 46, Wisconsin.

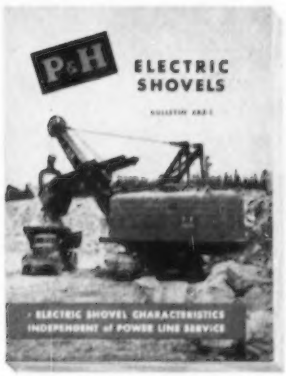
For Modern Engineering, Look to

HARNISCHFEGER

P&H ELECTRIC SHOVEL DIVISION

at the head Big Three?

CONTROLS give operators electric shovels



For a clearly illustrated description of Magnetorque* and how it sets a new standard for electric shovel design and operation, write for Bulletin X-156. Other booklets available on electric shovel models from 3 to 10 cu. yd. capacity. A copy of these publications will be sent those who request it on their company letterhead.

*T. M. of Harnischfeger Corp. for Electro Magnetic Type Coupling

CORPORATION *Milwaukee 46, Wisconsin*

the **P&H** *Line*

STRONGEST MOST MASSIVE JAW CRUSHER BUILT

Send for your copy of Traylor Bulletin 125 with complete specifications and features of all Traylor Type S Jaw Crushers.

Traylor Type S JAW CRUSHERS FOR HEAVY DUTY MINING OPERATIONS

Traylor Type S Jaw Crushers are designed to stand up under the most severe production schedules. Exclusive Traylor features assure peak production with an absolute minimum of maintenance and greatly reduced power requirements. Traylor original Curved Jaw Plates apply power as a direct crushing force. Lifting and churning of the feed is reduced . . . choking and packing is practically eliminated. This assures a more uniform product with less plate wear. As a result, Traylor Curved Jaw Plates often outlast ordinary plates by as much as 3 to 1.

Traylor Type S Jaw Crushers are custom built to meet your particular requirements and operating conditions. For example, a 48″ x 60″ Traylor Type S Jaw Crusher can be built to produce 220 tons of 3″ product . . . or 550 tons of 9″ product an hour . . . on a maximum of 180 H.P. The steel frames of Type S Crushers can be built in 6 sections to facilitate handling and transportation. Seven sizes offer production capacities up to 1,000 tons per hour with feed openings ranging from 36″ x 42″ to 60″ x 84″.

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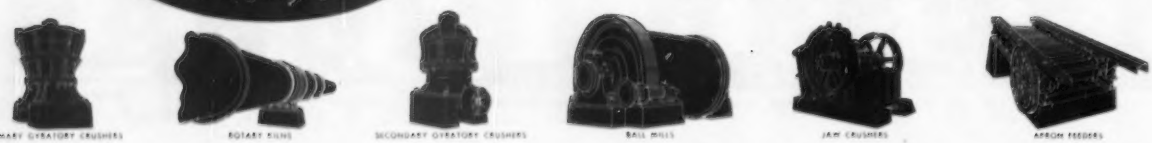
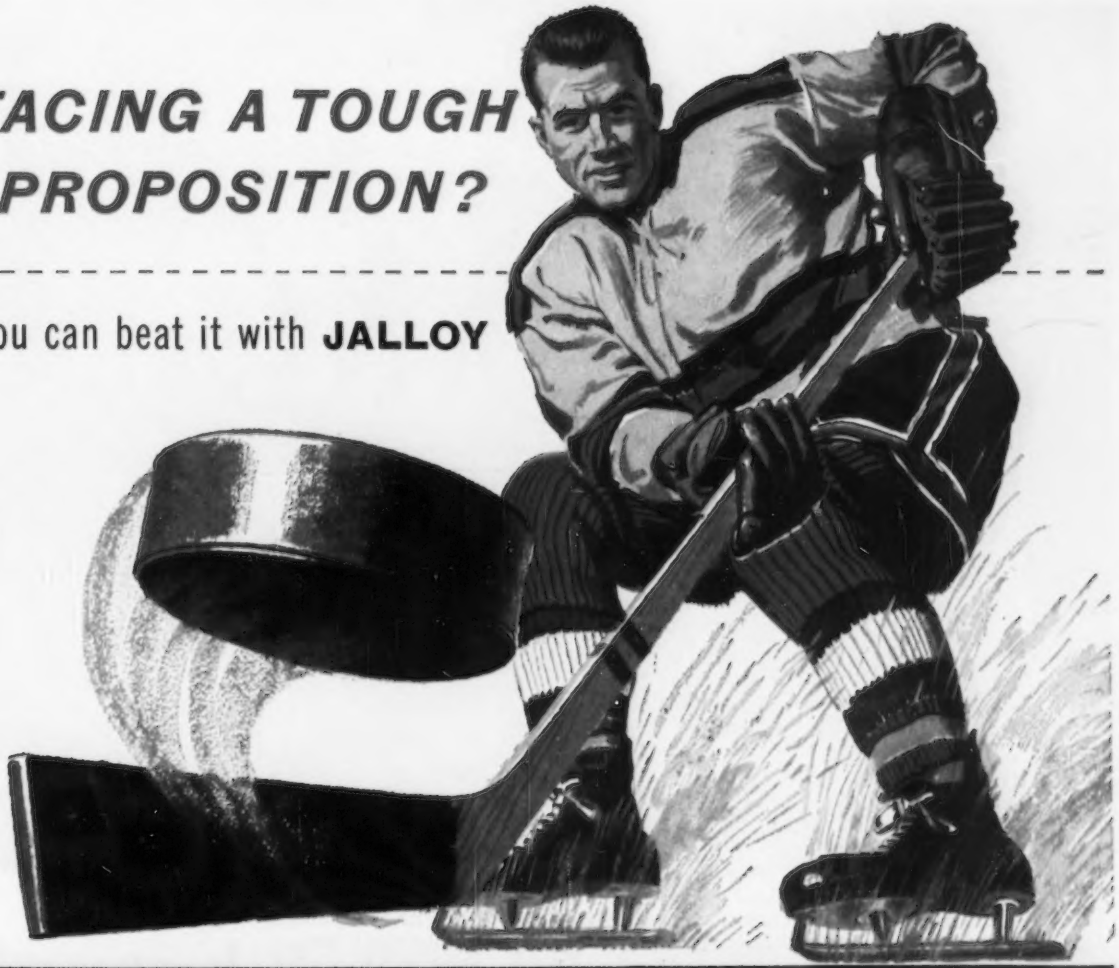
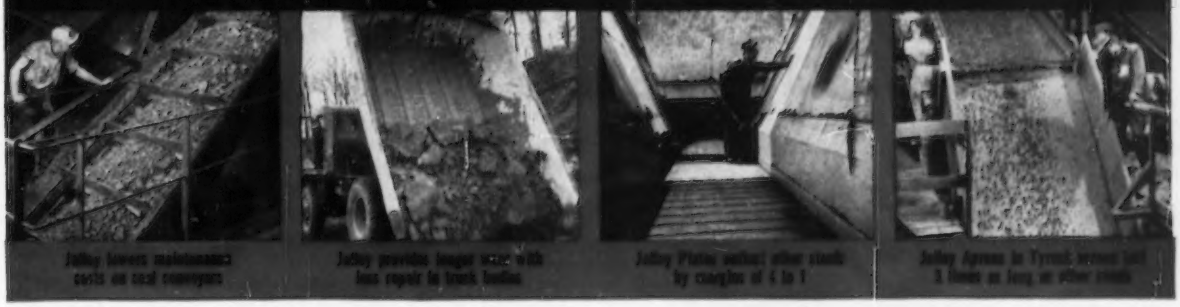


FACING A TOUGH PROPOSITION?

you can beat it with **JALLOY**



J&L JALLOY HEAT-TREATED PLATE BEATS WEAR DUE TO ABRASION



J&L Jalloy Heat-Treated Plate is the general purpose steel that is heat treated to provide longer wear on applications where impact and abrasive conditions are severe.

In comparison with other abrasion-resistant steels as well as mild steels, it gives optimum results when heat treated to a Brinell hardness of 340 and up. Jalloy permits savings in steel costs, maintenance, and repair. Furthermore, it is easily welded. Jalloy is available in three grades to meet various service requirements.

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Jones & Laughlin
STEEL CORPORATION — *Pittsburgh*

Complete data concerning CHEMICAL COMPOSITION . . . HEAT TREATMENT . . . WELDABILITY . . . PHYSICAL PROPERTIES . . . will be mailed to you promptly. Write today.

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☐ Please mail complete data concerning Jalloy.
☐ Please have your representative call.

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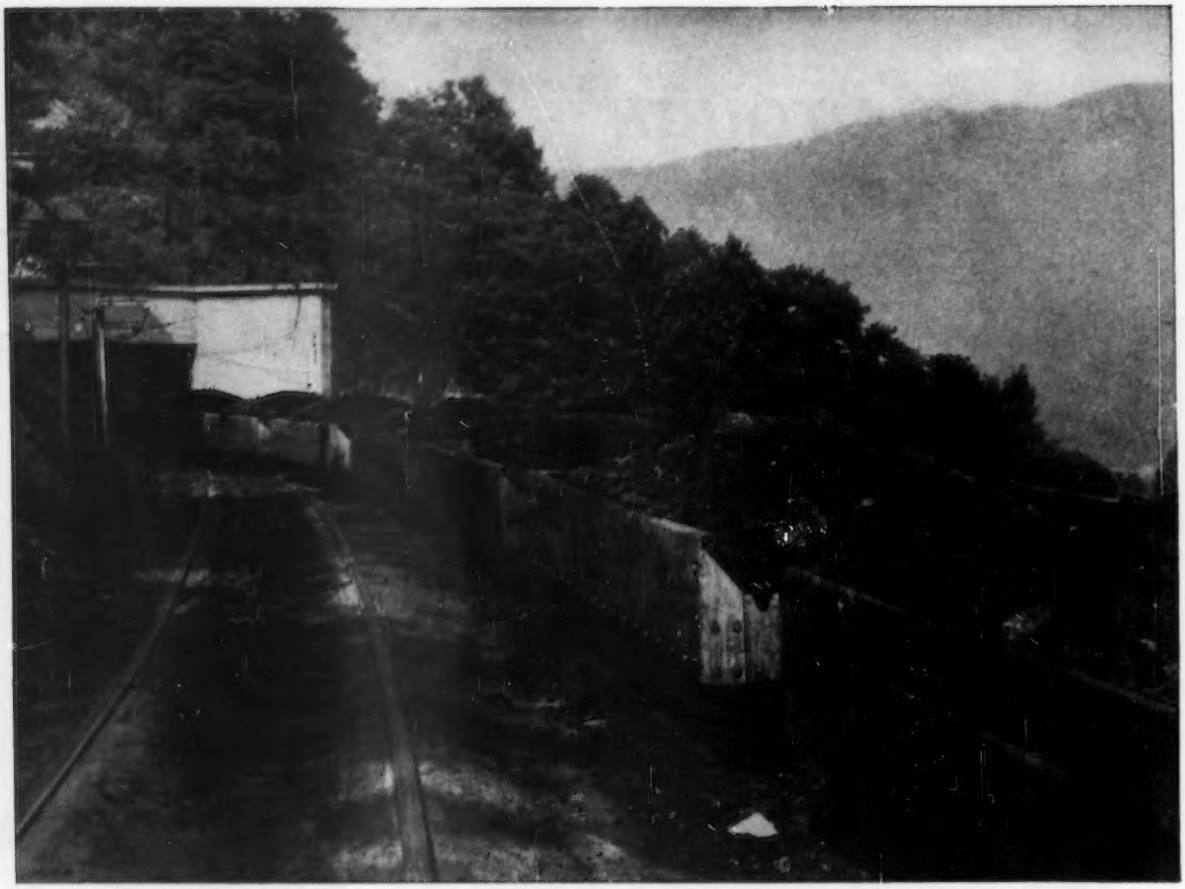
_____ _____



400-Car repeat order in 1954 tells better than any other words how the user's original 340 cars performed since 1941. All 740 cars, bought from ACF Industries, Inc., were built of COR-TEN Steel, a high strength, low alloy steel containing nickel.

Put your money in cars like these

...still good after 13 years' continuous use

THE FOLLOWING EXAMPLE is typical:

A West Virginia mining company bought 340 mine cars built of high strength, low alloy steel containing nickel . . . produced by United States Steel Corporation under the trade name of COR-TEN steel. After 13 years of resisting corrosion and battering, these 5-ton cars still remained in good operating condition.

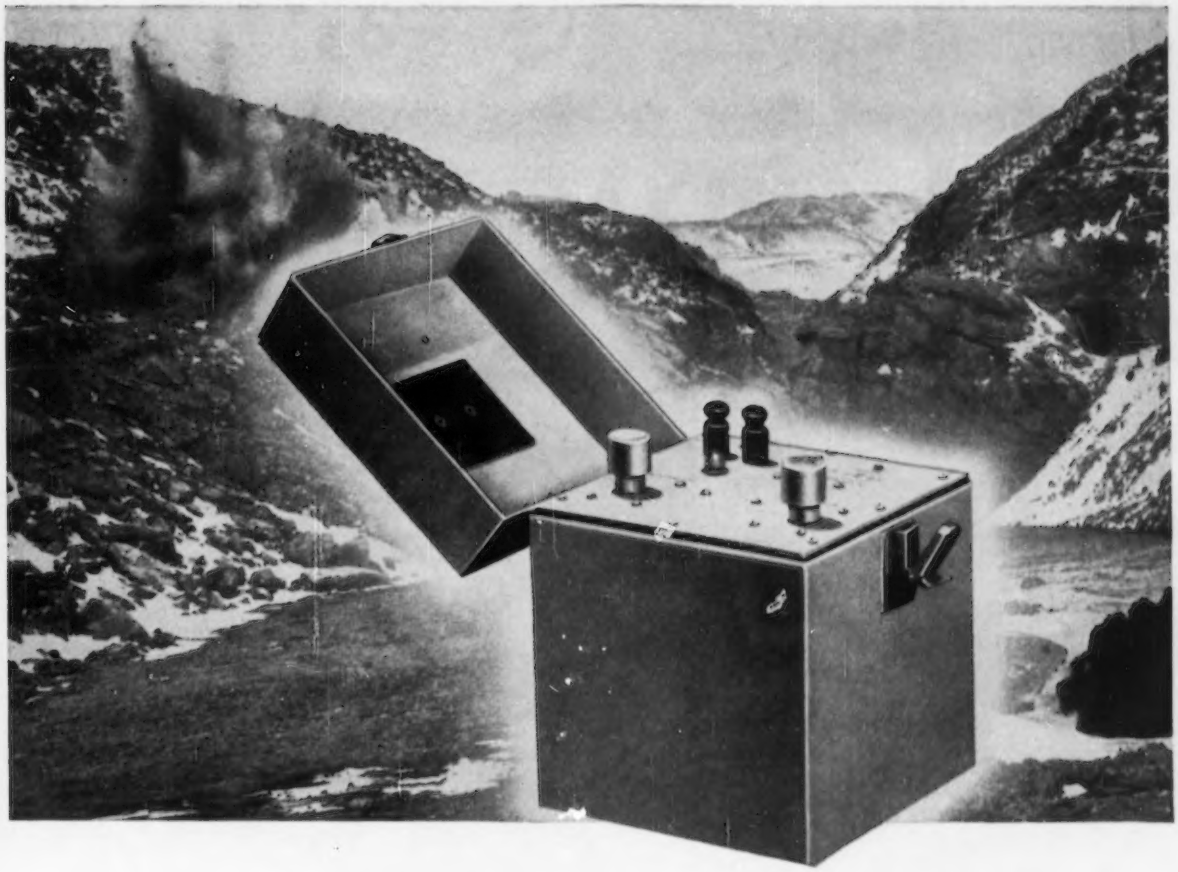
Impressed by this performance, the mining company ordered 400 more cars last year. Naturally, COR-TEN steel was again specified.

High strength, low alloy steels of this type have a 50% higher yield point than does structural carbon steel. Plus definitely greater resistance to impact, wear, fatigue and abrasion. Moreover, the nickel steels retain much of their original strength during years of use, because they offer five times as much resistance to atmospheric corrosion.

This means not only less maintenance, but greatly increased life for equipment made of high strength, low alloy steels containing nickel. So get all the facts . . . send for a copy of "Nickel-Copper High-Strength Low Alloy Steels."

It tells you why these nickel steels offer superior resistance to atmospheric and many other types of corrosion . . . how they act in sub-zero temperatures . . . their response to fabrication. It describes design factors that can help you cut deadweight. Write for your copy now and learn how these steels can save you money.

INCO TRADE MARK **THE INTERNATIONAL NICKEL COMPANY, INC.** 67 Wall Street New York 5, N.Y.



Improved Du Pont CD Blasting Machines

FASTER OPERATION—LESS MAINTENANCE

Improved performance during an extra-long service life is what you get from the newer Du Pont CD Blasting Machines.

Designated CD-32-1 and CD-48-1, these newly designed machines maintain the condensers in a fully charged condition at all times . . . preventing condenser deterioration and reducing current drain from the batteries to a negligible quantity. This keeps the condensers at the same potential as the batteries. Result: greatly prolonged battery and condenser life, less need for service in the field.

The continuous-charge feature also eliminates the elapsed time between depressing the ready switch and the lighting of the neon lamp. As soon as the ready switch is pressed, the light glows, and the blast can be fired at once by pushing firing button. Result: faster operation.

These powerful, efficient machines retain the excellent characteristics of all CD Blasting Machines: lightweight . . . great safety . . . no moving parts . . . absence of costly permanent shooting lines . . . ability to fire large numbers of caps in series or parallel series.

If you would like complete information on the improved CD-32-1 and CD-48-1 Blasting Machines, see the Du Pont explosives representative in your area, or write to E. I. du Pont de Nemours & Co. (Inc.), Explosives Department, Wilmington 98, Del.

OWNERS OF CD-32 and -48 BLASTING MACHINES may have them converted to the improved CD-32-1 and -48-1 machines for a moderate charge. Ask the Du Pont representative in your area for details.

DU PONT EXPLOSIVES

Blasting Supplies and Accessories

DU PONT

REG. U.S. PAT. OFF.

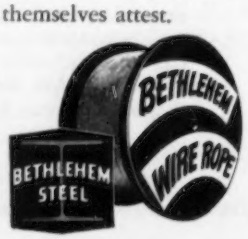
BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

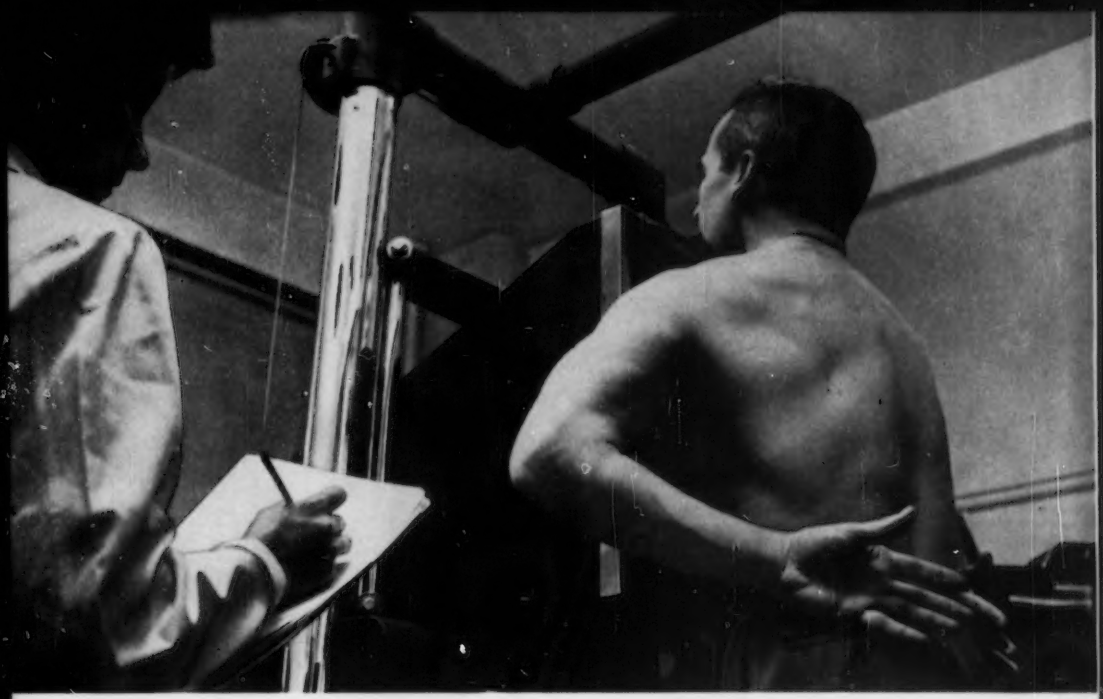
Wire Rope at Work — Large tonnages of coking coal are produced at this Southern mine, where an efficient twin-slope haulage system is used. From the mine proper, trains of heavily loaded cars are pulled up the slope to the tipple, there to be emptied and returned for more coal.

That big wire rope that seems to be zooming right out of the picture is one of the major haulage lines. Nearly two miles in length, it is a Bethlehem 1-in. Purple Strand rope, 6x19 Seale, with regular lay and fiber core. Long prior to the photograph it had built a reputation as a workhorse, with a haulage record of 1,000,000 tons in prospect. A very tough rope, the kind that really thrives on work, as the figures themselves attest.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem rope for the following industries and numerous others:
MINING • CONSTRUCTION • PETROLEUM • EXCAVATING • QUARRYING • LOGGING • MANUFACTURING





better health . . . because of BRICK

It is hard to associate X-rays with brick—the refractory brick which contains the fires of industry. Yet, were it not for brick these fine X-ray machines would never be made, and there'd be no electricity to operate them.

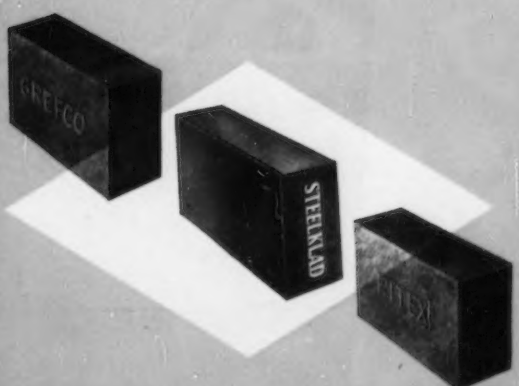
From an autoclave to an automobile, from a scalpel to a skyscraper, everything that's made and every form of transportation, communication and power owe their existence to refractory brick.

Our job is to provide that brick. In infinite variety. Compounded to formulas as precise as a prescription, in the world's largest refractories research laboratory. Moulded from materials brought from many countries in plants strategically located across our country to serve industry swiftly . . . dependably . . . economically . . . everywhere.

GENERAL REFRACTORIES COMPANY
Philadelphia 2

A COMPLETE REFRACTORIES SERVICE FOR THE COPPER INDUSTRY

Three types of basic brick—RITEX, GREFCO, STEELKLAD for the three basic processes—smelting, converting and refining. Each type of brick available in the ranges of composition—Magnesite, Magnesite-Chrome, Chrome-Magnesite and Chrome—required to adapt to variations in metallurgical processing.



RITEX—chemically bonded for low cost, superior workmanship, resistance to spalling, ready availability.

GREFCO—conventional type bonded by tunnel kiln high temperature firing, for maximum strength and hardness.

STEELKLAD—steel encased on two, three or four sides and for special jobs, steel plates incorporated in the brick interior as well—for maximum resistance to spalling in the most severely treated exposed walls.

RITEX, GREFCO and STEELKLAD—each the result of many years of intimate knowledge of the copper industry and careful study of service conditions, each prepared from the best available raw materials and made with the most modern manufacturing facilities—all within easy access to your operation.

GENERAL REFRACTORIES

for safety and speed
of coupling
in all types of mine cars
and locomotives

WILLISON
automatic
COUPLERS

Over 100,000 Willison Automatic Couplers have been installed in cars and locomotives engaged in mining operations, industrial plant hauling and foreign railway service. And the number is continuing to grow every day.

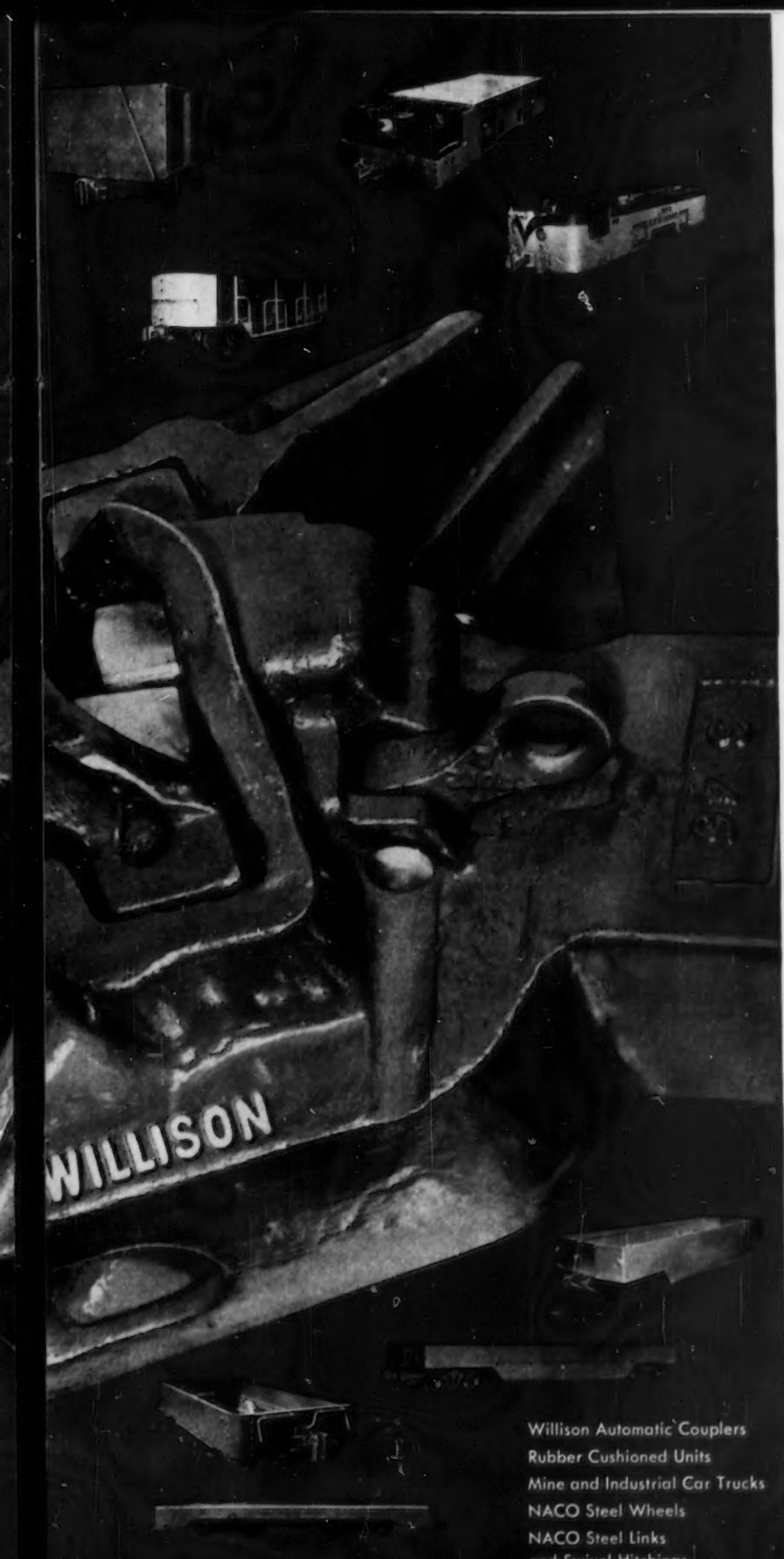
That's because operators know that with Willison Automatic Couplers you get three inherent advantages:

Safety — Since Willisons couple automatically and require no manual assistance, there is no need for men to go between cars.

Speed — Automatic operation and self-aligning feature speed coupling operations.

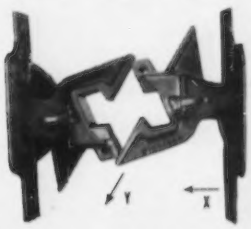
Strength — Willison Coupler heads take the full buff and pull forces. Strength does not depend on intermediate parts such as knuckles, pins and latching devices that are subject to failure.

If your operation involves haulage with cars of virtually any type in the 1 to 30-ton range, investigate the "3S" advantages — Safety . . . Speed . . . Strength — of Willison Automatic Couplers.

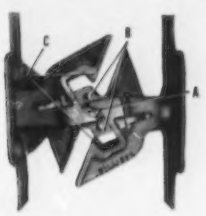


How the WILLISON COUPLER Works

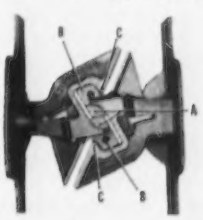
1. Wide gathering range of the Willison allows automatic coupling even under extreme curve conditions. Simple four-part construction cuts maintenance and parts problems.



2. Pressure of one coupler against the opposite coupler forces the two into correct coupling position as train movement (X) aligns couplers (Y).



3. Locks (A), pushing against each other, retract into coupler head and permit lugs (B) to slide along coupler face into interlocking jaws (C).



4. Locks (A), having cleared each other, return to locked position without pre-setting or manual assistance; lugs (B) are now held interlocked with jaws (C).

Willison Automatic Couplers
Rubber Cushioned Units
Mine and Industrial Car Trucks
NACO Steel Wheels
NACO Steel Links
and Swivel Hitchings

NATIONAL MALLEABLE AND STEEL CASTINGS COMPANY

CLEVELAND 6, OHIO

Circular 5154, Willison Automatic Couplers and Multi-Pad Cushioning Devices, available on request.

AA-1788

SYMONS®

CRUSHERS and SCREENS

have been serving CLIMAX MOLYBDENUM COMPANY for over 25 years

This Nordberg Machinery dependably serves CLIMAX in its expanding production of molybdenum

- 60-IN. SYMONS PRIMARY GYRATORY CRUSHER
- TWELVE 7-FT. SYMONS CONE CRUSHERS
- TWENTY-FIVE SYMONS ROD DECK SCREENS

High up in the Rockies in Colorado is the miracle mine of modern times. Its immensity marks an achievement unequalled in the industry and its glamour parallels to a marked degree the romance which has woven its way through mining history. Here, two and one-third miles above the level of the sea is located Climax Molybdenum Company . . . presently the largest underground mining operation in North America and the largest producer of molybdenum in the world.

As the percentage of pure molybdenum present in molybdenite ore is generally low and as it is usually found disseminated through hard, crystalline rocks, the importance of a successful method of reduction crushing can be appreciated. *As early as 1927,* Climax recognized the inherent advantages of Symons Cone Crushers. Later, after extensive testing of all types of screens, Climax standardized on the Symons Rod Deck.

Today, the greatly expanded Climax production depends to a large degree on Nordberg Machinery . . . a 60-inch Symons Primary Gyratory Crusher . . . TWELVE 7-ft. Heavy Duty Symons Cone Crushers . . . and TWENTY-FIVE Symons Vibrating Rod Deck Screens.

For at CLIMAX . . . *as in all of the great ore and industrial mineral operations the world over . . .* NORDBERG MACHINERY is the outstanding preference among leading producers for processing great quantities of finely crushed and screened product at low cost.

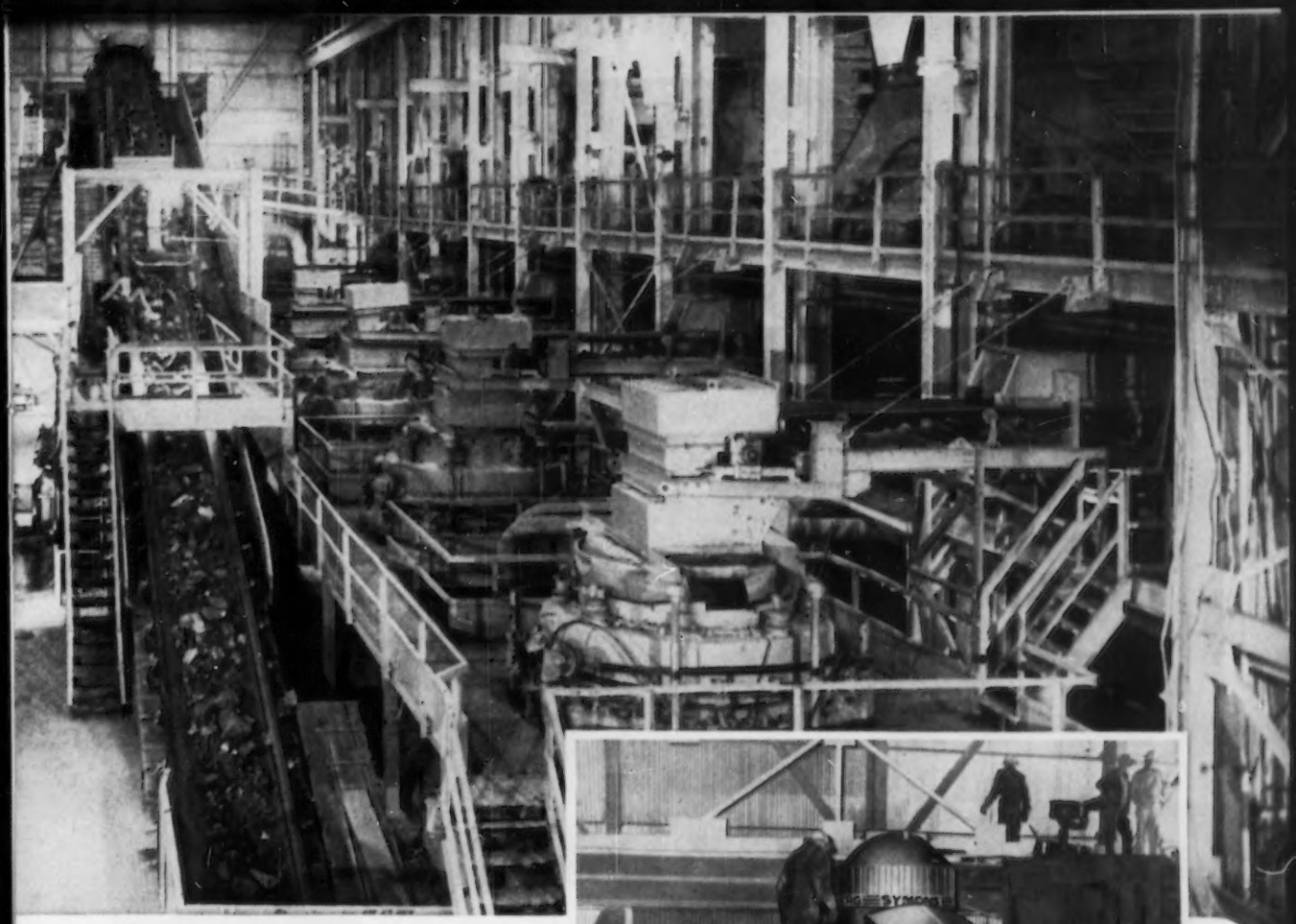
Write for further information on the machinery *you* need for the profitable reduction of ores and minerals.

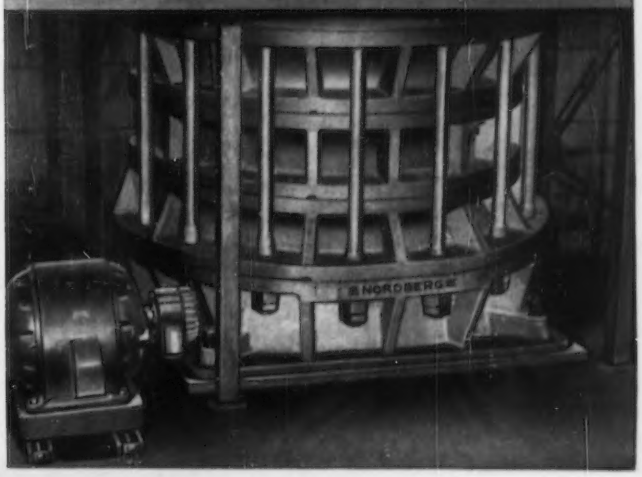
Record of Symons Crusher and Screen Installations at Climax:

SYMONS CRUSHERS

1927—1 4′ Standard	1953—1 7′ Short Head
1930—1 5½′ and	1 60″ Primary Gyratory
1 7′ Standard	
1933—3 5½′ Standards	
1935—2 7′ Short Heads	**SYMONS SCREENS**
1936—2 7′ Standards	1941—3 Rod Decks
3 7′ Short Heads	1942—5 Rod Decks
1937—2 7′ Short Heads	1943—7 Rod Decks
1952—1 7′ Short Head	1953—5 Rod Decks

NORDBERG MFG. CO., Milwaukee, Wisconsin





Above: **Five of the 12 Symons 7-ft. Heavy Duty Cone Crushers installed at Climax.**

Right: **60-in. Symons Gyratory Crusher used for primary breaking at the new Storke Level plant at Climax.**

Below: **Two of the 25 Symons Vibrating Rod Deck Screens installed at Climax.**

C655

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NORDBERG

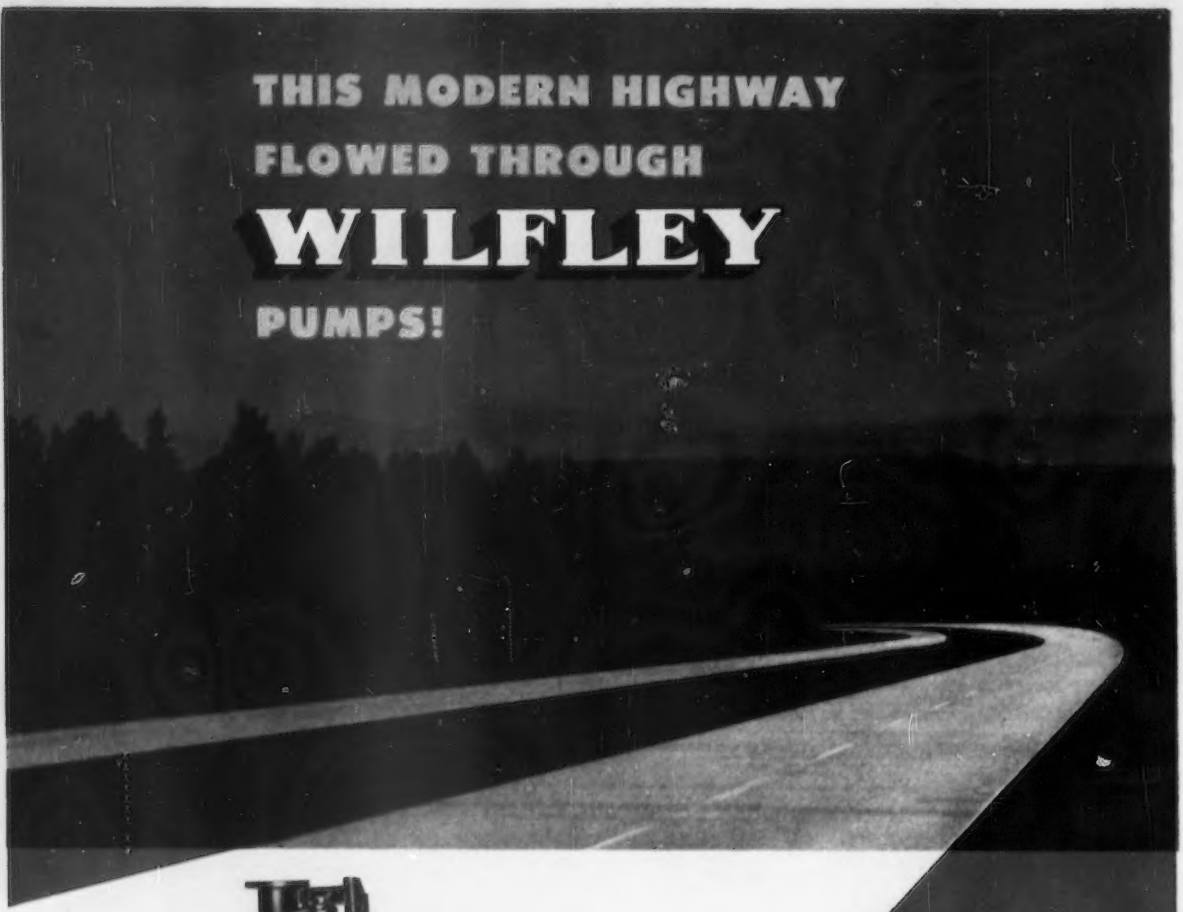
MACHINERY FOR PROCESSING ORES and INDUSTRIAL MINERALS

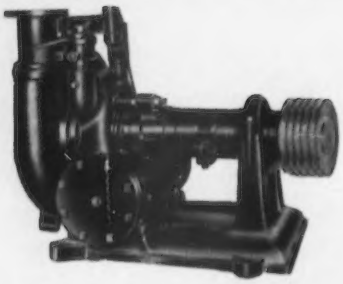
NEW YORK • SAN FRANCISCO • DULUTH • WASHINGTON
TORONTO • MEXICO, D.F. • LONDON • JOHANNESBURG

SYMONS...

A REGISTERED NORDBERG TRADEMARK KNOWN THROUGHOUT THE WORLD

THIS MODERN HIGHWAY FLOWED THROUGH WILFLEY PUMPS!





Many tons of the Portland cement for this important link in the transcontinental highway system were produced using Wilfley Sand Pumps. Wherever Wilfley Pumps are used, the record reveals stepped-up production and cost-saving efficiency. These famous pumps are synonymous with continuous, trouble-free, economical operation without attention. Let Wilfley solve your pumping problems. Individual engineering on every application. Write or wire for complete details.

Wilfley Acid Pump
"COMPANIONS IN ECONOMICAL OPERATION"
Wilfley Sand Pump

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ENGINEERING AND MINING JOURNAL

JANUARY 1956

Feed Materials—A Challenge

WILBUR E. KELLEY'S ARTICLE "Feed Materials Production—New Opportunity for Uranium Men" which starts on p 78, is stimulating and challenging. It reveals AEC's newly announced policy of inviting private industry to produce feed materials for atomic plants—specifically uranium metal, uranium trioxide and certain uranium fluorides. If the mining industry is to produce these materials—and strong interest in that direction is already apparent—new techniques common to the petroleum and chemical fields will have to be incorporated in uranium mill flowsheets. Thus uranium production from mine to refined product will become analagous to metal production from mine to refined ingot. The author skillfully poses the problems to be solved and the methods of attack as a guide to mining men.

This article suggests one other trend not only for the uranium metallurgist but for the entire metallurgical field—that the millman of the future will have to supplement his knowledge of crushing, grinding, flotation etc., with a working know-how of ion exchange units, high-pressure and high-temperature digestive and extractive processes, the safe handling of corrosive gases now little used in the mining industry, and perhaps catalytic steps to speed production.

Careful study of this article raises some interesting questions. For instance—if the proposed 5-year AEC feed materials purchase contracts can start as late as April 1, 1959 (thus running to April 1964), what impact will this have on the AEC ore and concentrate purchase program now extending to only 1962?

Secondly, what will happen to the Feed Material Production Center now operated for AEC at Fernald, Ohio by National Lead Co.? See picture p. 82.

Yes There is a Shortage of Engineers

OUR NOVEMBER EDITORIAL "Engineering in the Outfield" has stirred up a number of letters from engineers who doubt whether an engineering shortage actually exists in the mining industry. The gist of letters received is this—If there is really a shortage, why doesn't the mining industry try to hold onto the engineers already in the field, and offer greater inducements to new talent?

We repeat, a shortage does exist and it's growing. This assertion was made by H. DeWitt Smith, president of the American Institute of Mining and Metallurgical Engineers to members of the New York Local Section at its December meeting. When asked what could be done to encourage high school students, etc., to consider mining as a career, Mr. Smith countered by asking what the mining industry could do to make the field attractive to capable engineers.

His punch line was this, "We're getting a nice shortage of engineers, which like the present copper shortage, has only one solution—a higher price."

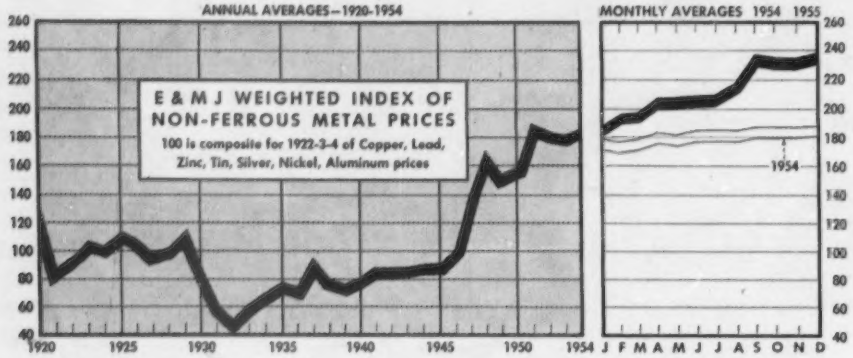
Now to clinch this thought, here are a few comments from one of our readers: "Despite a degree in mining from a well recognized university, and very sound basic training in mining, I have never been able to connect with one of those executive positions [which *E&MJ* says exist.] I can find executive positions in other industries, and for the past 20 years have been in mining, and out of it. When I am in it, I enjoy it very much, and when I am out, my wife and family live comfortably and eat well.

"A number of mining engineers of my acquaintance have left the mining industry during the past 10 years to fill executive positions in other industries.

"At present I am in the oil industry in an executive capacity, earning in excess of $20,000 a year. I like this business, but would enjoy mining much more. I wish you would show me the way to one of those mining executive positions of which you speak."

E&MJ OUTLOOK

PRICES



MARKETS

Price boosts in copper and tin pushed *E&MJ's* index to 236.88 for December, up 2.24 points from November's 234.64 level.

Heavy European demand was largely responsible for the year-end lead price increase to 16c New York. Similar pressures are on zinc prices.

Public Utilities are expected to spend $3- to $4-billion annually over the next ten years to expand power output from 480-billion kwh in 1955 to about 850-billion kwh by 1956. Expenditures for copper, aluminum, transformers and other power transmission equipment will total about $1.2-billion for 1956. This demand alone has doubled the order backlog of cable makers during the past year.

A new copper drainage tube, introduced during 1955 by brass mills, is gaining wide acceptance. One New York builder is erecting 2,600 homes with all-copper plumbing.

AT HOME

Lake iron ore shipments totalled nearly 87.5-million gross tons during the 1955 shipping season. Shipments via Canadian ports accounted for 3.3-million tons of this total.

Kennecott Copper Corp. has purchased the 3800-acre Butterfield Mines property in Bingham, Utah, from Combined Metals Reduction Co. The Butterfield property has been an important lead-zinc producer.

Uranium is still going strong. See pages 73 and 124.

LABOR

AFL won the election at Anaconda's new aluminum plant in Montana. Mine-Mill withdrew from the election to help AFL beat the Steel Workers.

As 1955 closed, a verdict was expected on the Maurice Travis Communist-membership case.

ABROAD

Iron Ore Co. of Canada mined about 8.5-million gross tons in 1955. The 1956 target is 10- to 12-million tons.

Kennco Explorations has acquired 500 mining claims about 20 miles southwest of American Metal Co.'s New Brunswick holdings. Early drillholes revealed lead-zinc values with some copper.

International Iron Ores, Ltd., incorporated by Cyrus Eaton, is formulating mining plans for a 600-square-mile concession south of Hudson Straits in northern Quebec.

First American depository receipts, representing shares of Union Miniere du Haut Katanga, world's third largest copper producer can now be bought by investors in the U. S. Formerly such transaction had to go through European brokers.

Nonferrous Metal Markets Stronger
December Domestic Copper Prices Rise

THE YEAR 1955 ended with the U. S. economy operating at the highest level it has ever reached. The Federal Reserve Board's index of industrial production in November was at 144% of the 1947-49 average when adjusted for seasonal variation. There were prospects the December figure would be 145%.

The *E&MJ* index of metal use by industry for December is estimated at 179% of the 1947 average, up one point from the November and October figure.

Non-ferrous metal prices rose about two points in December. The *E&MJ* December figure is 236.96% of the 1922-24 average.

Copper in the U. S. varied in price from 43¢ delivered to 50.3¢. The major producers stuck to the former price while major custom smelters lifted their top prices and by the middle of the month had reached 50¢ and late in the month went even a little higher. There are reports resale copper brought as much as 53¢. The weighted average varied from slightly over 45¢ to 42.7¢ fob refinery. This situation is indicative of a change in view among many copper factors—early in the fall the dominant view was that we were in for lower copper prices and this seemed to hold through October and well into November. It was supported by the rise in fabricator stocks month after month; the November statistics, available about Dec. 20, show an increase of about 20,000 tons. The heavy quantities of crude copper coming from the mines also tended to support this bearish sentiment. But about two months ago a more cautious note could be heard and it has grown as the year-end approached. By the middle of December regular domestic sellers had pushed up the price to the highest of the year. Many were agreed some fabricators had not been able to lift stocks as much as they had anticipated. It also appeared they might have revised upward their forecast of final consumer demand in early 1956. As the year ended some sellers reported they could sell copper even for third quarter 1956 delivery at 47¢. Most felt the 43¢ minimum would last into the second quarter at least.

At a time when purchasing executives were engrossed in determining copper-buying policy for 1956 the Chile copper workers went on strike. It started December 14 and as the year ended was still on—and about 20,000 short tons had been lost.

Anaconda workers are scheduled to return to work Jan. 5, after the Government had settled with the union and the company had compromised on a higher profit sharing plan. **Kennecott,** whose contracts with the unions ended Dec. 31, was negotiating new contracts.

Copper statistics in the following table, computed from Copper Institute data, show the maximum copper production and deliveries for any one year, and the November 1955 figure at an annual rate.

United States

	Maximum	Nov. annual rate
Production:		
Crude, primary	1,111,022 (a)	1,124,352
Crude, secondary	135,052 (b)	94,620
Totals	1,246,074	1,218,972
Refined copper	1,395,003 (c)	1,640,532
Deliveries, refined	1,643,677 (a)	1,701,684

World

Production:		
Crude, primary	2,399,192 (c)	2,743,752
Crude, secondary	145,293 (b)	111,648
Totals	2,544,485	2,855,400
Refined copper	2,515,069 (c)	2,879,556
Deliveries, refined	2,455,875 (d)	2,985,096

(a) 1943 (b) 1949 (c) 1953 (d) 1954

Above figures for the world do not include the period of World War II; the statistics for that period are uncertain.

Lead prices rose December 29 by ½¢ a lb. At N. Y. it is now 16¢ and at St. Louis it is 15.8¢. The preceding rise was on Sept. 23; on that occasion it was not until the 26th that all sellers were at the new price. This time all went up on the same day. The great demand and low stocks made it obvious to all that a rise was likely and in order though most did not expect it until January. But there was certainly no good reason for waiting. Lead prices in the U. K. and elsewhere in Europe were high enough to draw larger amounts from Australia, Mexico and other surplus producing areas. And when the U. S. price rose they immediately rose further. At the end of the month they were in the same relation to the U. S. price as before the rise here. Was the kind of demand pressure that had kept the price of copper rising now to be felt in lead? Was Europe now prepared to outbid the U. S. for lead? Are substitutes less of a problem in lead and would producers be more willing to let the price rise? The U. S. price is still under the 1951 and 1952 prices. As we go to press, lead on Jan. 4 was raised another ½¢ to 16½¢ N. Y.

Zinc continued to strengthen. The developments which preceded the lead price rise were as obvious in zinc. Many expect to see zinc raised early in January.

A summary of the October and November statistics of the American Zinc Institute, in tons, follows:

	Oct.	Nov.
Stock at beginning	42,167	43,868
Production	89,449	86,813
Production, daily rate	2,886	2,894
Shipments:		
Domestic	85,770	90,819
Export-drawback	36	280
Government acc't	1,942	1,561
Totals	87,748	92,660
Stock at end	43,868	38,021
Unfilled orders	61,746	64,560

Aluminum seems to be tighter than ever. Alcan, owing to a water shortage, will have less power than originally expected and the therefore is cutting back output by about 65,000 short tons during the January—April 20 period. Jan. 3 Alcan raised 1¼¢ to 22¼¢ a lb delivered to Canadian consumers. Last January Alcan raised and U. S. firms also.

Nickel is the center of considerable argument. Prices several times the 64½¢ charged by major producers are being obtained. It is in short supply and has been for some time. The price rose last on November 17, 1954 and was attributed to higher production costs. There is little doubt, many believe, that costs have risen considerably since then.

Quicksilver late in December showed signs of weakening. Much had been purchased for delivery in January at $270 per flask though the price for nearby metal did not drop below $280 for European and domestic.

Tin reached $1.10 in the middle of December. Trouble in South East Asia has contributed. Also the possibility of war in the Near East—some feel the Suez Canal might be shut off for some shipments.

Yearly Average Prices—1950-1955

(E. & M. J. Averages)

	1950	1951	1952	1953	1954	1955
Copper, dom., f.o.b. ref'y	21.235	24.200	24.280	28.798	29.694	37.491
Copper, foreign, f.o.b. ref'y	21.549	26.258	31.746	30.845	29.889	39.115
Lead, common, New York	13.296	17.500	16.467	13.489	14.054	15.138
Lead, common, St. Louis	13.096	17.300	16.266	13.288	13.854	14.942
Zinc, Prime Western, St. Louis	13.866	18.000	15.215	10.855	10.681	12.299
Tin, Straits, New York	95.539	127.077	120.473	95.845	91.838	94.735
Silver, foreign, New York	74.169	89.368	84.941	85.188	85.250	89.099
Quicksilver (per flask 76-lb.)	$81.258	$210.125	$199.097	$193.032	$264.386	$290.348
Antimony, N. Y. (cases, l.c.l.)	30.906	45.666	45.524	37.402	31.970	33.651
Platinum, refined	$76.556	$90.000	$90.000	$91.238	$83.897	$85.978
Cadmium (producers' quotation)	216.840	255.000	224.095	199.439	172.500	170.000
Aluminum, 99 plus percent, ingot	17.713	19.000	19.410	20.931	21.784	23.668
Magnesium, ingot	22.043	24.500	24.500	26.535	27.000	29.678
Nickel, electrolytic	44.792	54.000	56.500	59.888	60.453	64.500

MARKETS (*Continued*)

Average Prices December (E&MJ Quotations)

Copper:	
Electrolytic, domestic refinery	43.480
Electrolytic, export, refinery	44.665
Lead:	
Common, New York	15.558
Common, St. Louis	15.358
Silver and sterling exchange:	
Silver, New York, per oz.	90.450
Silver, London, pence per oz.	78.231
Sterling Exchange, "Checks"	280.260
Zinc:	
Prime Western, East St. Louis	13.000
Prime, Western, delivered (g)	13.500
Tin:	
New York Straits	107.774
New York, 99% min. (e)	106.774
Gold, per oz. U.S. price	$35.000
Quicksilver, per flask	$279.423
Antimony (*E&MJ*) (d)	36.470
Antimony, bulk, Laredo	33.000
Antimony, in cases, Laredo	33.500
Platinum, refined, per oz.	$103.769
Cadmium (a)	170.000
Cadmium (b)	170.000
Cadmium (c)	170.000
Aluminum, 99% plus ingot	24.400
Magnesium, ingot	32.500
Nickel (f)	64.500

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.

(a) Cadmium average based on the producers' quotations.

(b) Cadmium average based on the average of the producers' and platers' quotation.

(c) Cadmium average based on platers' quotation.

(d) Domestic, 5 tons or more but less than carload lots, packed in case f.o.b. New York.

(e) Tin content.

(f) F.o.b. Port Colborne, U.S. duty included.

(g) Delivered where freight exceeds 0.5c.

"Free" Gold Market

Gold transactions in December rose 30% above last month. Activities in London's gold market rose in preparation for the official free gold market opening in Brussels in January. Bar and coin prices remained stable in Europe, Asia and South America with moderate trading in most centers. There were some small Soviet sales. Pick's World Currency Report quotes on "free gold" per fine oz. as follows:

	COINS		BARS (12.5 kg)	
	Nov. 30	Dec. 31	Nov. 30	Dec. 31
NEW YORK, transit	.....	.....	$35.05	$35.05
MANILA	$39.50	$40.25	36.50	36.50
HONG KONG	40.15	40.75	37.75	37.85
BOMBAY	53.30	51.75	52.75	50.75
TANGIER	38.50	40.00	35.05	35.00
BEYROUTH	40.50	40.85	35.14	35.12
PARIS	41.30	42.10	35.80	35.85
BUENOS AIRES	40.50	38.25	36.00	35.35

Note: Prices are computed at the free or black market value of the U. S. dollar in the local markets.

Major Metals

U. S. DAILY AND AVERAGE PRICES

Dec. 1955	Electrolytic Copper (a) Domestic	(b) Export	Straits Tin New York	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis
1	43.425	44.150	101.375	15.500	15.300	13.500	13.000
2	43.175	44.325	102.250	15.500	15.300	13.500	13.000
3	No Market	44.325	102.250	15.500	15.300	13.500	13.000
5	42.925	44.500	103.750	15.500	15.300	13.500	13.000
6	42.875	44.625	104.375	15.500	15.300	13.500	13.000
7	42.975	44.500	105.375	15.500	15.300	13.500	13.000
8	43.000	44.950	109.250	15.500	15.300	13.500	13.000
9	44.200	43.725	109.000	15.500	15.300	13.500	13.000
10	No Market	43.725	109.000	15.500	15.300	13.500	13.000
12	44.075	45.000	109.500	15.500	15.300	13.500	13.000
13	44.350	43.900	110.000	15.500	15.300	13.500	13.000
14	45.300	43.450	110.000	15.500	15.300	13.500	13.000
15	43.650	45.150	110.000	15.500	15.300	13.500	13.000
16	43.450	45.500	110.000	15.500	15.300	13.500	13.000
17	No Market	45.500	110.000	15.500	15.300	13.500	13.000
19	43.400	45.400	109.500	15.500	15.300	13.500	13.000
20	43.350	44.850	109.375	15.500	15.300	13.500	13.000
21	43.375	44.275	109.375	15.500	15.300	13.500	13.000
22	43.775	44.000	109.250	15.500	15.300	13.500	13.000
23	43.050	44.600	109.250	15.500	15.300	13.500	13.000
24	No Market	44.600	109.250	15.500	15.300	13.500	13.000
26	Holiday	Holiday	Holiday	Holiday	Holiday	Holiday	Holiday
27	42.750	42.925	108.500	15.500	15.300	13.500	13.000
28	42.700	44.475	107.750	15.500	15.300	13.500	13.000
29	44.300	46.700	107.750	16.000	15.800	13.500	13.000
30	42.975	46.075	108.000	16.000	15.800	13.500	13.000
31	No Market	46.075	108.000	16.000	15.800	13.500	13.000
AVERAGES FOR MONTH							
Dec.	43.480	44.665	107.774	15.558	15.358	13.500	13.000
AVERAGES FOR WEEK							
Dec.							
7	43.075	44.404	103.229	15.500	15.300	13.500	13.000
14	44.185	44.125	109.458	15.500	15.300	13.500	13.000
21	43.445	45.113	109.708	15.500	15.300	13.500	13.000
28	43.069	44.120	108.800	15.500	15.300	13.500	13.000
CALENDAR WEEK AVERAGES							
Dec.							
3	43.105	44.479	100.792	15.500	15.300	13.500	13.000
10	43.195	44.338	106.792	15.500	15.300	13.500	13.000
17	44.165	44.750	109.917	15.500	15.300	13.500	13.000
24	43.390	44.621	109.333	15.500	15.300	13.500	13.000
31	43.181	45.250	108.000	15.800	15.600	13.500	13.000

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Dec. 1955	Sterling Exchange "Checks"	Silver (c) New York	Silver London	Gold London	Gold (d) United States
1	280.2232	90.750	77.750d.	249s. 8d.	$35.00
2	280.2053	90.500	77.750d.	249s. 7⅞d.	35.00
3	(e)	(e)	(e)	(e)	35.00
5	280.1696	90.500	78.000d.	249s. 8d.	35.00
6	280.1250	90.160	78.000d.	249s. 8⅛d.	35.00
7	280.0848	90.160	77.750d.	249s. 8⅛d.	35.00
8	280.1383	90.160	77.750d.	249s. 8⅛d.	35.00
9	280.1875	90.160	77.750d.	249s. 7⅞d.	35.00
10	(e)	(e)	(e)	(e)	35.00
12	280.2901	90.160	78.000d.	249s. 7d.	35.00
13	280.4196	90.160	78.250d.	249s. 6d.	35.00
14	280.4642	90.750	78.500d.	249s. 4⅞d.	35.00
15	280.3928	90.750	78.750d.	249s. 4⅝d.	35.00
16	280.2991	90.750	78.750d.	249s. 5⅛d.	35.00
17	(e)	(e)	(e)	(e)	35.00
19	280.1875	90.500	78.625d.	249s. 6⅛d.	35.00
20	280.2812	90.500	78.125d.	249s. 7d.	35.00
21	280.2812	90.500	78.375d.	249s. 5⅞d.	35.00
22	280.2812	90.500	78.500d.	249s. 6⅛d.	35.00
23	280.2500	90.500	78.500d.	249s. 6⅜d.	35.00
24	(e)	(e)	(e)	(e)	35.00
26	Holiday	Holiday	Holiday	Holiday	Holiday
27	280.2946	90.500	Holiday	Holiday	35.00
28	280.3958	90.500	78.500d.	249s. 6d.	35.00
29	280.2321	90.500	78.500d.	249s. 5⅛d.	35.00
30	280.2500	90.500	78.500d.	249s. 6⅛d.	35.00
31	(e)	(e)	(e)	(e)	35.00
AVERAGES FOR MONTH					
Dec.	280.260	90.450	78.231d.	—	35.00
AVERAGES FOR WEEK					
Dec.					
7	280.162	90.414	—	—	35.00
14	280.300	90.278	—	—	35.00
21	280.288	90.600	—	—	35.00
28	280.305	90.500	—	—	35.00

Calendar Week Averages: New York Silver: Dec. 3rd, 90.600; 10th, 90.228; 17th, 90.514; 24th, 90.500; 31st, 90.500.

(e) No Market (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash. New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.300c per pound, the average differential for delivery charges.

(b) Our export quotations for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent. Atlantic seaboard. On f.a.s. transactions we deduct 0.075c for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West, effective Jan. 1, 1951, commanded a premium of 1.35c per pound over the current market for Prime Western; Special High Grade 1.75c effective Dec. 1, 1955.

(f) Prime Western delivered where freight from E. St. Louis exceeds one-half cent.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 pounds.

(c) The daily silver quotation reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually one quarter cent below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5 per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U.S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

London Metal Exchange Quotations

Dec.	COPPER Cash Bid	COPPER Cash Asked	COPPER 3 Mo. Bid	COPPER 3 Mo. Asked	LEAD Current Month Bid	LEAD Current Month Asked	LEAD 3 Mo. Bid	LEAD 3 Mo. Asked	ZINC Current Month Bid	ZINC Current Month Asked	ZINC 3 Mo. Bid	ZINC 3 Mo. Asked	TIN Cash Bid	TIN Cash Asked	TIN 3 Mo. Bid	TIN 3 Mo. Asked
1	384	385	374	375	109¾	110	109¼	109½	95	95½	93¼	93½	788	789	776	777
2	388	389	379	379½	110½	110½	109½	110	96¼	97	93½	93¾	798	799	783	783
5	386	387	375	376	110½	110¾	110	110¼	97¼	97¾	94	94½	805	806	789	790
6	392½	393	379	380	110¾	111¼	110¼	110½	98	99	94½	94¾	812	812½	799	801
7	390	391	379	380	111¼	111½	110½	110¾	98¾	99	94¾	95	809	810	800	801
8	394	395	384	384½	112	112½	111	111¼	99½	100	95¼	95¾	823	824	813	814
9	394	394½	384½	385	111½	112	110¾	111	97	98	95¾	95½	822	825	814	815
12	397	398	391	392	112¼	113	111¼	111¾	97¾	98	95¾	95½	827	828	816	817½
13	400	401	393	394	113¾	114	112¾	113	99	99¼	96	96½	836	840	823	825
14	400	401	393	394	112¾	113	112	112¼	97½	98	95	95¼	840	841	822½	823½
15	404	405	396	396½	112¾	113	112¼	112½	97¾	98	95¼	95½	832½	835	815	816
16	395	396	388	389	112¾	113	112½	112½	97½	98½	95½	95½	834	837½	819	820
19	402	403	396	396½	112¾	113	112½	112¾	98	98½	95½	95¾	834	835	815	816
20	400	401	394	394½	113¾	114	113½	113¾	98¼	98½	95¾	96	831	832½	811	812
21	397	398	390½	391½	114	114½	113¾	114	98½	99	96¼	96½	828	830	807	808
22	390	391	386	387	114¾	115	114½	114¾	98¾	99¼	96½	96¾	827	830	808	810
23	393½	394½	389	389½	115½	115¾	114¾	115	99	99¼	97	97¼	828	829	807	807½
26	Holiday															
27	Holiday															
28	398	399	393	394	115¾	116	115	115¼	99¼	99½	97¼	97½	828	830	807	808
29	396	396½	390	391	116¾	117	116	116¼	99¾	100	97	97¼	830	831	809½	810
30	399½	400	393½	394	120	120½	118¼	118½	101	101½	98½	98¾	831½	832	812½	813
Av'g's	£395.475		£387.775		£113.344		£112.638		£98.438		£95.694		£823.963		£807.825	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.97%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments f.o.b. New York unless otherwise stated, tons of 2,000 lb unless otherwise noted.

MISCELLANEOUS METALS

Dec. 31, 1955

Aluminum ingot, 99 plus % lb			24.4¢
Antimony, spot, lb, less than carload, in cases			36.47¢
In bulk, carload lots, f.o.b. Laredo			33.00¢
Bismuth, ton lots, lb			$2.25
Cadmium, commercial sticks, delivered, lb			$1.70
Calcium, lb, ton lots, 98%, cast			$2.05
Chromium, 97% grade, lb, contract			$1.25
Cobalt, 97 to 99%, per lb			$2.60
Germanium, lb			$295.00
Indium, troy oz			$2.25
Lithium, lb, 98%	$11.00	@	$14.00
Nickel, cathodes, lb, f.o.b. Port Colborne (a)			64½¢
Magnesium, 99.8%, carloads, lb, producer's plants, Freeport, Texas			32½¢
Palladium, troy oz	$23.00	@	$24.00
Platinum (wholesale lots) troy oz	$97	@	$117
Quicksilver, flask of 76 lb, 25 flasks or more	$275	@	$279
Selenium, 99 plus %, lb	$9.00	@	$10.00
Silicon, minimum 97%, carloads, lb			20½¢
Tellurium, lb			$1.75
Thallium, 100 lb or more, lb			$12.50
Titanium, 99.3 plus, grade A-1, max. 3% iron, lb			(b)$3.45

(a)Includes U. S. duty. (b)Effective Nov. 23, 1955.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, per short ton unit	$36.00	@	$38.00
Chrome Ore per long ton, f.o.b. cars Atl. ports, dry:			
44% Cr_2O_3 no ratio	$23.50	@	$24.50
48% Cr_2O_3 3 to 1 ratio	$44.00	@	$53.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:			
Old Range bessemer			$10.40
Mesabi bessemer			$10.25
Mesabi, non-bessemer			$10.10
Lead (Galena), 80%, Joplin, Mo., ton			$202.25
Manganese Ore—Per long ton unit of Mn basis 48% manganese, nearby positions, subject to premiums and penalties $1.12 @ $1.17 c.i.f. U. S. ports, duty extra. Long-term contract nominal at 94 @ 96¢ c.i.f. duty extra.			
Molybdenum Ore, 90%, per lb of Mo f.o.b. mines			$1.05
Columbium-Tantalum, per lb, combined oxides			(a)
Tungsten Ore, per unit of WO_3:			
Foreign 60%, c.i.f. U. S. ports, duty extra	$33.50	@	$34.00
Domestic, scheelite, 60% f.o.b. mill			$63.00
Vanadium Ore, per lb of contained V_2O_5 f.o.b. mines			31¢
Zinc Ore, Prime, 60% concentrate, Joplin, Mo., per ton			$80.00

(a) Nominal.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb, in bbl carload lots delivered			5½¢
Cobalt Oxide, 72½% to 73½%, ceramic grade, per lb	$1.96	@	$1.97½
Copper Sulphate, 100 lb			$14.90
Germanium Oxide, lb			$142.00
Molybdic trioxide, technical, per lb of Mo	$1.24	@	$1.25

ALLOYS

Ferrochrome 65 to 69%, per lb of Cr. (4–9% C)			26¼¢
Ferromanganese, 74 to 76%, net ton, seaboard			$205
Ferromolybdenum, 55 to 65% Mo, lb of Mo contained	$1.54	@	$1.66
Ferrosilicon, 50% per lb of Si f.o.b. shipping point			12¾¢
Ferrotungsten, 72 to 82%, lb of W contained			$3.30
Ferrovanadium, per lb of V delivered	$3.10	@	$3.30
Silicomanganese, max. 1½% carbon, lb, contracts			11.5¢
Spiegeleisen, per long ton, 19 @ 21% grade			$91.50

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds) ton:			
Crude No. 1	$960	@	$1,500
Crude No. 2	$595	@	$900
Spinning fibers	$321	@	$514
Shingle fibers	$150	@	$200
Paper stock	$109	@	$137
Waste			$77
Shorts	$35	@	$70
Asbestos, f.o.b. Vancouver, B. C. (U. S. funds):			
Spinning fiber, 3-K			$460
Shingle fiber, 4-K			$185
Asbestos, Vermont, f.o.b. Hyde Park:			
Spinning fibers	$279.50	@	$302.00
Shingle stock	$135.00	@	$162.00
Paper stock	$81.50	@	$115.00
Waste, stucco or plaster			$71.40
Refuse or Shorts	$34.00	@	$63.00
Barytes f.o.b. cars:			
Georgia, crude, per ton			$15.00
Missouri, 94% $BaSO_4$, per short ton			$14.25
Bauxite, long ton, f.o.b. point of shipment:			
Domestic crude, 50 to 52% (not dried)	(a)$5.00	@	$5.50
Domestic, chemical, 55 to 58%	(a)$8.50	@	$9.05
Domestic, abrasive, 80 to 84%	(a)$18.00	@	$18.50
Feldspar, bulk ton:			
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50	@	$22.25
Glass feldspar, white, 20 mesh	$11.75	@	$12.50
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$33.00	@	$34.00
60% effective CaF_2	$28.00	@	$28.50
Acid 97% concentrate, bulk, ton			$47.50
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00	@	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington			$40.00
Mica—Domestic, f.o.b. mines. Punch 12 to 22¢ per lb according to size and quality. Sheet clear, 1½ x 2-inch, 70¢ to 85¢; 2 x 2 inch, $1.10 to $1.60; 2 x 3 inch, $1.50 @ $1.60; 3 x 3 inch, $1.80 @ $1.90; 3 x 4 inch, $2.20; 3 x 5 inch, $2.40; 4 x 6 inch, $3.15; 6 x 8 inch, $4.25. Wet ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground: $32.50 @ $70.00 per ton. Scrap $25 and up.			
Ocher, Georgia, ton, in sacks	$26.50	@	$30.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports			Not quoted
Sulphur, prime, Texas, mines, long ton			$26.50
Talc, f.o.b. works, ton:			
New York, purified	$18.50	@	$20.00
Vermont, extra white			$13.50
Tripoli, Missouri, ton:			
40-mesh, cream colored			$30.00

(a) Nominal.

IRON AND STEEL

Pig iron, gross ton, basic, Valley Furnaces			$58.50
Steel f.o.b. Pittsburgh, billets, net ton			$68.50
Structural shapes, Pa., Ala. etc., 100 lb	$4.50	@	$4.60

THIS MONTH IN MINING

Daniel P. Eigo

Mexican Tax Law Is Altered To Aid Small Mine Operators

REVISED MINING LAWS, passed in late December by the Mexican legislature, will provide a boost for large and small miners, with the latter group receiving the greater benefits.

Ever since the April 1954 peso devaluation of 44.5%, which brought with it a boost in export taxes from 15 to 25%, mine operators have been petitioning the government to do something about the 19 different taxes which can now be applied to mining and could take 37% of gross receipts.

Although the new laws reduce taxes under certain circumstances, many major operators do not feel that they go far enough. However, other large producers (perhaps more realistically) recognize that the new laws represent as much of a concession from the government as could be hoped for at present.

For operators of small mines, the new basis for tax rebates has been broadened from 200,000 pesos (US $16,000) per month to 250,000 pesos (US $20,000). These amounts refer to taxes paid to the government. Under the old law, in effect since July 1953, rebates were granted on a sliding scale to small miners whose production required them to pay 200,000 pesos in government taxes each month. Any mine which produced enough to pay more than 200,000 was not considered a small mine and could not qualify for the rebate. New law extends mines covered to include the group which produce in the 250,000 pesos a month group. Under law, only 75% of the taxes paid may be rebated.

Under the old law, a miner whose taxes amounted to about 10,000 pesos could hope to have only about 60% of the 75% which was rebatable. Now, miners who pay up to 25,000 pesos will have the entire 75% returned. Miners whose taxes are more than 25,000 will still receive rebates on a sliding scale.

Ing. Salvador Pena, chief of the technical department of mining of the Treasury Department, said that the changes were made to encourage and protect small mine operators and to help insure miner employment. About 800 mines, employing some 20,000 miners, will be affected. While some 98% of the small mines are Mexican, several of the larger companies operating in Mexico will have small units which qualify as small mines.

Tax concessions granted the larger companies take the form of "convenios fiscales," or "special financial arrangements." Situations which may apply in receiving the concessions include: working of low-grade deposits; mining where natural conditions impose high costs; conducting exploration where reserves are dwindling, or in important mineral districts; keeping a marginal mine operating (for the welfare of the miners); constructing roads and the like to permit mining; building metallurgical plants to increase efficiency; and where renovation of equipment is necessary and the operator cannot afford the cost.

Also included among the conditions under which concessions may be asked, are: where compensation for losses is necessary to continue operation; where the operator, despite efficient operation, still does not receive a reasonable profit from his property.

Burden of proof of the conditions, the law says, rests with the operator and any concessions granted are subject to annual review.

In addition, the new laws are, in effect, expected to reduce direct production taxes and simplify their collection. Generally, the new laws are not what the major companies have been striving for, but most independent observers feel they represent a long stride forward on the part of the government of Mexico.

Juneau USBM Laboratory Will Test Uranium Ore

INCREASED number of uranium finds in Alaska has prompted USBM to install equipment to test ore samples at the Juneau office of the Territory Department of Mines. Addition of the Juneau office brings the number of laboratories equipped to check for radioactivity to eleven.

Examinations, which are conducted under a cooperative agreement with AEC, have averaged 3,000 samples per month at all stations, three times the monthly rate in the first six months of 1954.

GSA Purchases Manganese, Tungsten and Other Ores

GOVERNMENT PURCHASES through Sept. 30, 1955, of domestic tungsten, manganese, chrome and beryl were announced by Edmund F. Mansure, head of GSA.

The tungsten program called for purchase of 3-million short ton units; by Sept. 30 GSA had bought 2,153,101 short ton units.

Beryl purchases authorized amounted to 1,500 short tons of which 774 tons had been bought.

Chrome authorizations were 200,000 long tons of ores and concentrates of which 93,985 tons have been bought.

Manganese authorizations totaled 31-million long ton units. Of this, by Sept. 30, GSA had bought 10,762,552 recoverable units.

Mica may be purchased in three forms —block, film and hand-cobbed. Purchase of 25,000 tons of hand-cobbed mica or the equivalent were authorized. Block or film mica weighing 90 lb is considered the equivalent of one ton of hand-cobbed. Total deliveries have been 6,999 tons of all types.

Nonferrous crysotile asbestos in three grades, Nos. 1, 2 and 3, is accepted. Authorizations for a total of 1,500 short tons of Nos. 1 and 2 were made; No. 3 is accepted on a tie-in basis with the other two grades and is not included in the total allowance. To Sept. 30 a total of 1,093 short tons of Nos. 1 and 2 were bought. Also 540 tons of No. 3.

Final Cargoes Hauled From Iron Range

ORE SHIPS left the lower lake ports in late November for final cargoes of the 1955 shipping season. Total cargoes for the Pittsburgh Steamship division of U. S. Steel, the largest fleet on the Great Lakes, was set at approximately 23.6-million gross tons of ore. Mark is the largest in any peacetime year and fourth largest in the history of the organization.

Oliver Iron Mining division of the big steel firm shipped a total of some 36.2-million gross tons during the season, 9½-million more than 1954 according to R. T. Elstad. Shipments included 6-million tons of concentrates, 10% of which were taconite nodules and sinter.

New Mexico Firm Mines Gold, Silica and Copper

A "MOUNTAIN OF MINERALS" may have been discovered by Onego Corp., which is in the process of mining silica, gold, copper, iron and silver at Oro Quay Peak in the San Pedro mountains of New Mexico, 47 miles southwest of Santa Fe.

Richard R. Spurrier, Santa Fe, former state geologist for New Mexico says that "geological examination indicates the claims contain probably the richest mineral deposits of gold, copper, silica and iron found in New Mexico in the last decade. Onego has been mining silica at the Aunt Martha mine, a 40-ft seam which reportedly assays some 99.68% pure.

Gold was discovered below the silica workings in what was apparently an old mine shaft, bulkheaded and concealed many years ago. Samples have shown some very rich ore. The old mine showed a small, but widening seam of gold running down the shaft.

Another abandoned, and carefully concealed gold mine shaft was found when a bulldozer fell in a caved-in section of ground. Neither of the old gold mines appears to have been worked. Some 9% grade copper is claimed by the company at another mine on the mountain, which also has gold values.

On another section of the area, Onego says it has 5-million tons of high grade iron ore proved by exploratory shafts down to the 200 level. Onego has purchased and reconditioned a concentrating mill for handling the gold ores at San Pedro.

Patent Examiners Needed

U. S. PATENT OFFICE urgently requires engineers and scientists with a college degree in engineering or applied science or a college degree with a major in chemistry or physics, according to a recent announcement. Salaries, Patent Law Association officers say, start at $4,345 with potential of $7,570 in 5½ years. Vacations and benefits are liberal. Further information may be obtained from the Commissioner of Patents, Washington 25, D. C.

Mining Calendar

Mining Symposium and AIME meeting, Duluth, Minn., Jan. 9, 1956.

University of Minnesota 17th Annual Mining Symposium. Duluth, Minn., Jan. 10-11.

Colorado Mining Association "Exposition and Mining Confab," Feb. 2-4, 1956, Denver.

Sixth Annual meeting, Govenor's Industrial Safety Conference, Mineral Extraction section, Feb. 2-3, San Francisco.

American Institute of Mining and Metallurgical Engineers, annual meeting, Feb. 20, Hotel Statler, New York City.

Symposium on Rock Mechanics, sponsored by the Colorado School of Mines, Golden. April 23-25.

Institute of Lake Superior Geology, Houghton, Mich., May 11-12.

American Congress on Surveying and Mapping—American Society of Photogrammetry consecutive meetings, Shoreham Hotel, Washington, D.C. March 18-24.

Mining News *(continued on p 124)*

As we went to press . . . .

AEC announced institution of a system of competitive bidding for leasing uranium deposits developed by the AEC on withdrawn public lands "and certain areas under AEC control." No extensive leasing is planned in the near future, according to chairman Lewis L. Strauss, "since ore production from privately-owned properties is being maintained at a high level."

Lands, which consist of former purchases by the Manhattan Engineer District and withdrawals for exploration, will be leased "to the acceptable bidder offering the highest cash bonus by sealed bid. Royalty rate, work requirements and other conditions will be stated in the invitation to bid. These conditions will be determined by the AEC, and will be based on the estimated size and grade" of deposit and cost of mining and production.

American Smelting & Refining Co. has agreed to extend its contract with the Atomic Energy Commission for operation of ore-buying stations until Jan. 31. The Government agency is reported to be considering three of the original eight bidders for the contract to take over the AS&R-operated facilities. (See p 136)

Cerro de Pasco has sent an exploration drilling crew to investigate the Rio Blanco copper deposit, 35 miles northwest of Santiago, Chile. Deposit is porphyry, contains principally sulphide minerals.

Tentative agreement for merger of Sabre Uranium Corp. and Pinon Uranium Co. has been reached, say spokesmen. American Metal Co. will also participate in the new company, which is developing uranium in McKinley County, N. M., in an area which shows "very good promise," according to AEC officials. (See p 124)

Participants are said to be negotiating with AEC for a mill at the mine location, which would also be operated by American Metal under a management contract.

Purchase of columbium-tantalum at the Custer, S. D. depot by General Services Administration was halted Dec. 30. A. J. Walsh, GSA commissioner, said no more purchases will be made because deliveries exceed the national quota of 15-million lb. Bulk of the quota was filled through imports, principally from Nigeria.

Total shipments to the Custer depot, which handled about 95% of domestic columbium-tantalum production, were about 25,000 lb of ore for the year.

Carl J. Trauerman, 70, secretary-manager of the Mining Association of Montana and long-time correspondent for *E&MJ*, died at his home. A leading figure in western mining and possessed of a host of friends in and out of the industry, his death came as a great shock to all who knew him and his work.

Milling facilities at Climax Molybdenum Co.'s operation at Climax will be expanded, with addition of a ball mill unit, largest phase of the project, to cost some $800,000. Addition will be used either to increase recovery from current tonnage, or to step up output by some 3500 tpd on the present recovery basis.

Behind the By-Lines . . .

G. P. Lutjen

Appropriately enough, January seems to be "Homecoming Issue." At least three of our authors are back after short absences. On page 88, H. Ferid Kromer reports on "Mining in Turkey," a comprehensive report of what's going on, mineral-wise, in the Baghdad circuit. Mr. Kromer's last by-line in E&MJ was back in April 1954 when he went all out on the chrome ore situation in Turkey.

In that same April 1954 issue was a report on Kitimat forwarded by John Kearney from a split level igloo up in British Columbia. Mr. Kearney is with us again with a story on the modernization of a Mexican iron mine on page 94 of the current number. This represents his first appearance since his excellent round-up of the Mexican sulphur situation in January 1955. Mr. Kearney, formerly News Editor on the E&MJ staff, spent two weeks in Mexico getting the sulphur story and apparently liked it so well that he's now down there on a permanent basis with the McGraw-Hill World News Bureau.

Our third returnee is C. C. Austin. Last time we heard from him was in the October 1954 issue when he was riding a bicycle around some mine in Scandinavia. This time, Mr. Austin is clear around the other side of the world, filling us in on the titanium situation in Hawaii on page 98. As they say out in the Islands, "Me ke aloha pau ole," which freely translated means, "Man! I'm green with envy!"

Our Miss Ryan is wearing a worried frown these days. You are probably saying, "So what?" So here's what: Miss Ryan, among myriad other responsibilities, sees to it that all your requests for more information on equipment discussed in the New Products Digest (see page 35, this issue) reach the manufacturers concerned. All the reader has to do is circle the numbers on the postage-free reply card included in the NPD, put down his name and address and send it in. Miss Ryan and the manufacturer do the rest. Most of the time the operation is pretty cut and dried for everybody involved. However, ever since the Dodgers won the World Series, we've been having trouble. At least a half a dozen people in the October, November and December issues, have forgotten to write in their name and address after circling the numbers and before mailing. You have no idea how difficult this omission makes things for Miss Ryan. Please be more careful in the future.

Outer space is just around the corner! It seems like only yesterday that the U. S. Navy's rocket, Viking, went cruising up (or is it "out") to an altitude of 158 mi in man's most prodigious attempt to date to get out of this world. Fascinating as this excursion was, it left something to be desired in the way of reporting on things outside the ionosphere. Flight time was only about 5 minutes and its path virtually a straight line up and then down.

For further investigation of the wild blue yonder, scientists are now planning to launch a missile which will circle the earth in its own orbit, thus extending both the coverage and time of the Viking. In fact, though it is now referred to as the "Satellite," the original designation of the project was LPR—long playing rocket.

Our source for this bit of whimsy is Dr. Alan T. Waterman, director of the National Science Foundation. Dr. Waterman also filled us in on other details. The satellite will cruise around the world in an orbit from 200 to 300 mi out at a speed of some 18,000 mph, taking about 90 minutes to circle the earth.

How the satellite gets out there is the Navy's secret; they're delivering it f.o.b. on orbit. Otherwise the whole project's unclassified and all cooperating nations in the project will be given information to help in tracking the satellite. Dr. Waterman says that it will be visible if you know where to look. If that's not enough, radio signals will be transmitted from the satellite. These signals will be mainly concerned with relaying information from whatever instruments are on board.

The satellite may remain on orbit for two or three weeks but it will gradually spiral in. As it gets into the denser atmosphere near earth, the friction caused by its great speed will burn it up completely. As soon as possible data radioed from the satellite will be released for scientists everywhere to make of it what they will.

We've never met the daughter of the Hon. Norman P. Mason, commissioner of the Federal Housing Administration, but we'd like to. She summed up the whole economic situation of the wage-earning householder in one sentence. As reported by Commissioner Mason in discussing FHA with a group of editors, the mortgaged man is universally faced with the problem which his daughter defines as "too much month left at the end of the money."

Our beachcomber friend reports that he was conducting some sociological research in his favorite pub the other night when a sporty character in a mink Homburg wheeled in, ordered a double bourbon, swallowed it in one gulp, slapped a five dollar bill on the bar, and walked out without another word.

"How do you like that phoney?" demanded the bartender. "Orders a double bourbon, gives me a five dollar tip, and walks out without paying the tab!"

Worried about Communism? We were until we saw the following translation of the popular Polish song entitled "What Makes a Woman Attractive":

"Why is she so attractive that every boy looks at her
When she walks in the evening through the streets of Warsaw?
Her work is what makes her so beautiful;
Every boy would like to marry a girl like her.
This morning she mixed cement at the building site;
Tonight she attracts the interest of every boy."

She's lovely! She's engaged! She uses Portland Cement!

DR. HARRY V. WARREN (left), University of British Columbia, comments on his paper, highlight of the convention at the Saturday luncheon, for E. C. Stephens, Anaconda Co., and Lowell B. Moon, exploration manager, Bear Creek Mining Co.

MALCOLM C. BROWN, chairman, Resolutions Committee, notes resolution with Karl W. Jasper, NWMA president.

Uranium Dominates NWMA Meeting

GROWING CONCERN with federal mining policies and exuberant new interest in uranium ores were reflected in sessions of the Northwest Mining Association in Spokane, December 2-3. This 61st meeting was the biggest to date: more than 615 registered by banquet time Saturday evening, topping last year's official figure by 100. There were 130 registered for auxiliary sessions and 65 students from northwest colleges attended.

Miles P. Romney, manager, Utah Mining Association, declared in the opening session that the need for a national minerals policy is acute.

"The condition of domestic mining ranges from poor to critical and its future is uncertain," said Mr. Romney. "Mineral policy has consisted of plans and pleas for production during emergencies, and indifference to the needs of the industry once adequate supplies are available."

In summing up the situation, Mr. Romney stated, "The Western states have much to gain in continuing their campaign to gain consideration for our basic industries. We have come a long way in the past few years. We still have much to do, principally to increase the understanding of the economic interdependence between the West and other segments of the domestic economy."

Another speaker urged miners to consider the "long look"—and forecast that "our problem won't be a problem of demand." This was Dr. J. R. Van Pelt, president of Montana School of Mines, who said increased construction and equipment would result in increased demands for mineral production. He urged the mining industry to establish programs to attract young engineers and to conduct research.

Mining is developing new tools to

J. B. HAFFNER, president, International Oils and Metals Co., was appointed NWMA trustee.

FRANK N. MARR, Spokane-Idaho Mining Co., was NWMA convention vice chairman.

REGISTERING at AIME auxiliary desk on opening day were (left to right) Mrs. Wing G. Agnew, Mrs. Robert J. Hundhausen and Mrs. J. K. Matthews.

AMONG THE SPEAKERS at the session on Canadian Mining (left to right) were J. W. Scott, Dr. John F. Walker, J. B. Shannon, H. E. Doelle, and Donald E. Smith.

SUNSHINE MINING MEN (clockwise), James C. Durham, Robert M. Hardy Jr., R. N. Breckenridge and J. B. Colson, chat with W. W. Staley, University of Idaho.

ROGER V. PIERCE (center) Salt Lake City consultant, discusses drilling techniques with E. R. Borcherdt (left), and R. M. Stewart, of the Anaconda Company.

keep up with future demand, according to Roger V. Pierce, Salt Lake City consulting engineer. He told a technical session that soon the entire bore may be extracted in one chunk or in nonstop cutting in mine shafts and tunnels. A rotary drill developed in the West Virginia coal fields has bored two holes 6 ft in diameter to depths of 500 feet.

Inventors of the device contracted drilling at $45 per foot plus bit costs of approximately $6 per ft. Mr. Pierce reported watching the machine drill 8 ft in eight hours.

Vincent D. O'Leary, mine superintendent for Anaconda at Butte, described rock bolting and untimbered horizontal cut-and-fill stoping that improved operations in the deep mountain Con Mine. He said, "Rock bolting was first introduced in sill work. Internal pressures, air slackening due to humidity changes, and concussion from blasting had dictated that nearly every foot of Mountain Con advance be timbered. This not only slowed down the work but involved doing a third more excavation than was necessary. With rock bolting, sills are driven in a shape conforming to a Gothic arch. Bolts are installed in a predetermined pattern, and every heading is kept bolted within 2 or 3 ft of the breast. Result has been that useless excavation has been turned into feet of advance so that as much as 100% increase has been noted in some headings. The over-all cost has been decreased by $7 per foot of advance."

A burlap and sawdust calking used successfully for hydraulic stope filling at the Blackbird Mine in Idaho was explained by Cecil J. Whitley, chief engineer, Calera Mining Co.

Uranium Delegation

For the first time in the NWMA's annual conventions, scores of uranium mining men attended as delegates. One of the best attended sessions dealt with uranium.

Robert J. Hundhausen, Dawn Mining Co. manager at Midnite Mine on the Spokane Indian Reservation, said a 500-ton sample of ore recently was shipped to Grand Junction, Colo., for mill testing on a pilot plant scale. The company will have fairly accurate data on milling methods and costs when tests are completed in 60 to 90 days. Then the firm can choose an efficient process and design a mill.

A high discovery rate for uranium still is necessary to assure adequate U. S. production, according to Ernest E. Thurlow, chief of the AEC exploration branch at Salt Lake City. Mr. Thurlow said that "with increased interest in prospecting, several more

interesting discoveries can be expected in the Spokane region."

Despite the major uranium discoveries recently, Mr. Thurlow added, most of the domestic reserves for a long-term atomic program remain to be found or developed. He described Spokane Indian Reservation deposits as a new geologic environment for significant concentration of uranium.

A paper prepared by E. C. Bitzer, president of Nuclear Metals Corp., described an acid leach process for uranium which he said afforded higher recoveries than alkaline treatment. He reported that types of anion exchange resins, in contact with pregnant uranium solutions, absorb uranium salts. The resins are sufficiently selective that a concentration of 10 to 1 can be accomplished.

Mr. Bitzer's paper said that ion exchange treatment of a pregnant solution assaying 1 gpl would yield an upgraded "eluate" containing around 10 gpl of U_3O_8. The resin, loaded with uranium, can be regenerated with a chloride or nitrate solution to remove the uranium and leave the resin for recycling.

Canadian Uranium

Uranium also entered a discussion of Canadian mining at a session devoted to Dominion developments. In 2½ years, the Algoma (Blind River) district in Ontario has revealed uranium ore valued at more than $800-million. Donald E. Smith, general superintendent, Pronto Mines, Ltd., added that construction in the area will provide mills with a total capacity of 15,000 tons daily. Mr. Smith said the district "shows promise of becoming the largest single uranium producing center in the world."

J. W. Scott, manager of Rexspar Uranium and Metals, Ltd., said his firm's three-year-old property is the only active uranium development in British Columbia. With low-grade ore, the company hopes to become the first B.C. producer.

J. B. Shannon, superintendent of the Reeves MacDonald Mines, described long blast hole drilling. He said "training old miners with old habits was one of our big difficulties in using machines" for drilling. And he declared the cooperative efforts of crews are more important than drill speeds in an efficient operation. Mr. Shannon said a two-man team breaks 400 tons of ore per bit shift at Reeves MacDonald.

A. L. Allan, mine superintendent for Britannia Mining and Smelting Co., described powder blasting applications. Recent developments and a historical glance at the northern areas of British Columbia were outlined by Dr. John F. Walker, deputy minister of mines for the Province.

In a session on exploration, C. C. Goddard, geologist for Bear Creek Mining Co., told about a helicopter airlift that permitted the firm to develop its copper properties high in the Cascades a year earlier than possible when equipment was hauled in by pack train. The company spent 11c per pound for a horse trip 14 miles into the camp, and only 19c per pound for helicopter lifts.

By using air, the Bear Creek firm could begin work in June and drill to September. By pack train, heavy snows prevented entry until June and time was lost in setting up.

Geochemical prospecting has been successful in locating surface deposits, Professor Forbes Robertson of the University of Washington, told the session. But research is needed on geochemical prospecting for deeper deposits.

E. B. Olds, superintendent of the Crescent division, and D. C. Long, geologist, of Bunker Hill & Sullivan Mining & Concentrating Co., described use of the jack leg for long hole exploration. Geology of the Hercules Mine was discussed by Garth M. Crosby, senior geologist, Day Mines, Inc.

Rex N. Anderson, Pacific Coast mining manager for Westinghouse Electric Corp., told a session on applying atomic power, that such power will supplement other forms of energy. Atomic-generated electricity, he said, offers the greatest promise for meeting electricity demands in the future.

Applications of Physical Metallurgy were described by Assistant Professor S. A. Duran of Washington State College, and uses of non-ferrous alloys outlined by Professor Joseph L. Newton, University of Idaho, in an AIME session.

Minerals and Health

In an entertaining speech at the Saturday luncheon, Dr. Harry V. Warren, professor of geology at the University of British Columbia, described minerals and their effect on health. Endemic anemia tendencies in the Fraser River area can be traced to rainfall which washes iron from the soil, he explained, and a zinc deficiency affects apple growth in the Okanogan area of Washington State. Cobalt added to salt ended sleeping sickness, and an infection of Florida grapefruit was cleared up by spraying with a dilute solution of molybdenum.

Convention resolutions committee noted with alarm the increasing number of permanent withdrawals of land from public domain for military and other uses. In a statement adopted by the convention, the resolutions asked for assurance of adequate local publicity for withdrawal requests and public hearings if a protest is lodged.

(Question of Military withdrawals of public lands has been in the spotlight recently in Congress; at the Western Governors Mineral Policies Conference, Sacramento, Calif., Nov. 7-8; and at the American Mining Congress meeting, Las Vegas, Nevada, Oct. 10-13. For further comment, see Letters, p 110 of this issue.)

The resolutions opposed the general cession to states of any rights in public domain lands that would interfere with mineral locations, and opposed the extension of the Leasing Act system to minerals.

Changes in Policy

Although the convention endorsed the American Mining Congress "declaration of policy" at its meeting October 10-13, the NWMA asked for some changes in the policy:

1. Change the discovery provision of the general mining laws to provide a reasonable period of protection to those, who in good faith seek a discovery.

2. Make assessment work cumulative for each $100 in excess of $100 per claim but not in excess of five years after the year the work was performed.

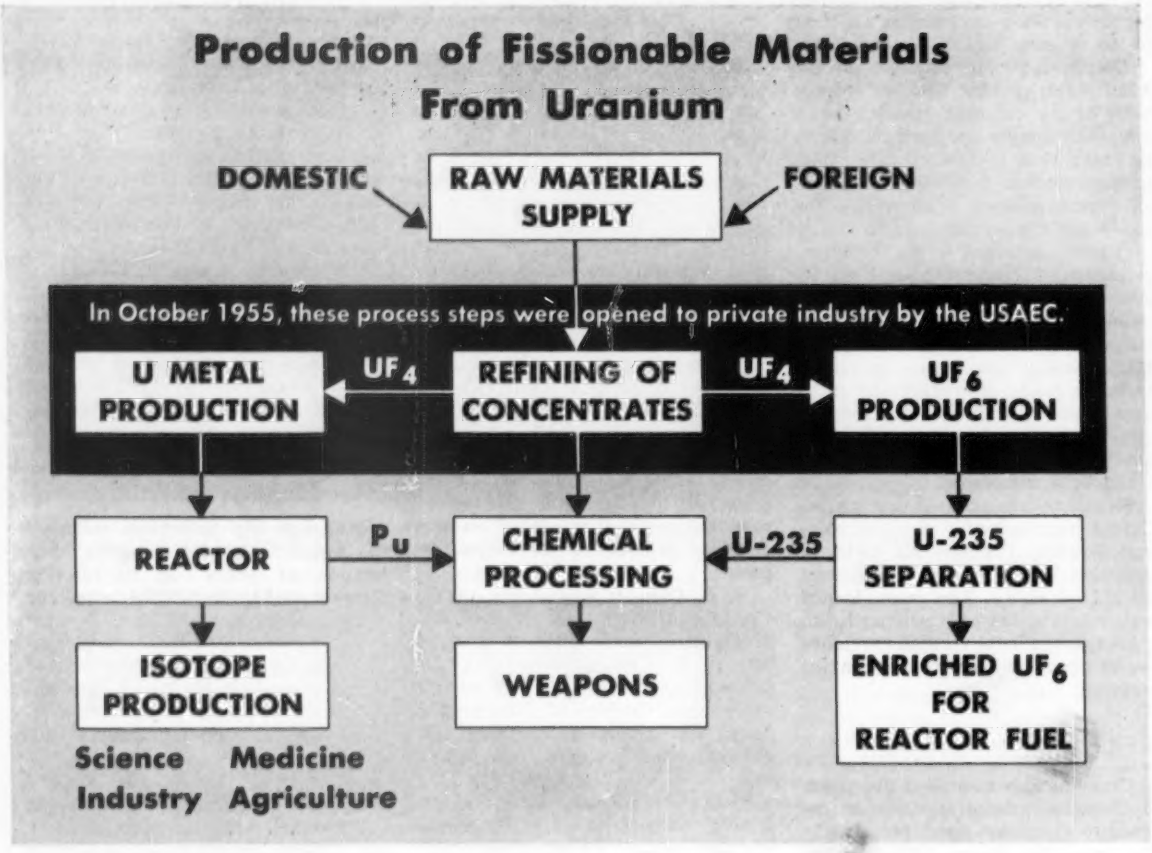
3. Change the dates for completing assessment work from July 1 to October 1.

4. Failure to record assessment work should bring termination of a claim by forfeiture.

5. Permit location of a 40-acre legal subdivision without extralateral right and without the need for a special survey for a patent.

Delegates re-elected Karl W. Jasper, Grandview Mines, for his third term as president of the association. They named as other officers: P. Evan Anderson, consulting geologist, vice president; Ross D. Leisk, Sunshine Mining Co., vice president; E. K. Barnes, First National Bank, Spokane, treasurer; Robert J. Towne, Towne Equipment Co., secretary, and Mrs. Amy Satterson, NWMA, assistant secretary.

Five new trustees appointed were J. B. Haffner, president of International Oils and Metals Co., Wallace Woolf, general manager, Bunker Hill and Sullivan; E. H. Lovitt, Lovitt Mining Co.; Ralph Neyman, general manager, Hecla Mining Co.; and J. C. Kieffer, manager of northwest mining operations for AS&R.



Feed Materials Production—

WILBUR E. KELLEY, Vice President
Catalytic Construction Co.
Philadelphia, Pa.

ADDITIONAL OPPORTUNITIES for private industry in uranium processing were opened up when the Atomic Energy Commission announced on October 27, 1955, that it was soliciting proposals for the production of refined uranium salts in privately owned and operated facilities. Up to this time, the Commission has completely controlled the production of feed materials. This decision represents a very important and progressive step in the expansion of the scope of private participation in the uranium industry. It will permit industry to extend its operations beyond the current limitations of mining and milling.

"Feed materials" operations are those dealing with the processing of high-grade ores and ore concentrates to metallic uranium for use at Hanford and Savannah River and to uranium hexafluoride gas for the diffusion plants at Oak Ridge, Tennessee; Paducah, Kentucky; and Portsmouth, Ohio. These operations are separate and distinct from the field referred to as "raw materials," which includes geological surveys, mining and milling of uranium-containing materials, to produce ore concentrates. These ore concentrates are shipped to feed materials plants at St. Louis and Fernald, Ohio.

There is considerable misunderstanding, even among those closely associated with the atomic energy field, about the categories of processes that are included in the area arbitrarily designated by the AEC as "feed materials operations." The term has never properly reflected the responsibilities assigned to various AEC Operations Offices, nor has it adequately identified materials that are truly important feeds to the atomic energy program.

However, AEC has now specifically stated that it is interested in receiving proposals from qualified firms to process uranium ores or concentrates to uranium trioxide (UO_3), uranium tetrafluoride (UF_4) or uranium hexafluoride (UF_6). Where proposals are based on delivery of UF_4 or UF_6 the Commission will accept proposals calling for delivery of uranium trioxide (UO_3) on an interim basis pending completion of UF_4 or UF_6 production facilities.

The Commission will consider proposals for any production rate up to a maximum of 5,000 tons U_3O_8 equivalent per year.

Proposals may be based on arrangements whereby the U_3O_8 concentrates are supplied by the Commission and refined salts returned, or on direct purchase of the refined salts from a company having, or obtaining, its own supply of uranium ores or concentrates. In the latter case, the Commission will consider appropriate modifications in contracts now in effect between the AEC and suppliers of uranium concentrates.

Since the original announcement of this new policy, the AEC has announced that it is willing to let five-year purchase contracts. It was specified that proposals should provide for deliveries to commence as early as possible, preferably on or before April

Concerning Kelley

"Vice president" is the way Wilbur E. Kelley's title reads in Catalytic Construction Co.'s annual report. And in the archives of the University of Louisville are recorded his B.S. and C.E. degrees and an honorary Doctorate of Engineering. But these are only a part of the background that so emphatically certifies Mr. Kelley as an expert in the care and feeding of the atomic energy industry.

Long before words like "feed materials" and "green salt" had any significance for most people now in the uranium business, Wilbur E. Kelley was tangling with the problems of atomic energy.

In September 1942, Mr. Kelley was one of the first engineers assigned to the Manhattan Project. Commissioned a major in the Corps of Engineers in April 1943, he was selected as project chief and later, operations chief, of the $350-million Electro-Magnetic Separation plant (Y-12) at Oak Ridge, Tenn. This was the plant that produced the first U-235 for use in atomic weapons.

In May 1947, Mr. Kelley was named manager of the New York Operations Office of the U. S. Atomic Energy Commission, a position he held until he joined Catalytic in March 1953.

As manager of the AEC's New York Operations Office, Mr. Kelley supervised the processing of uranium and other ores; the procurement of special materials and devices; the administration of more than 300 prime contracts for research, development and procurement, including the contract for the operation of Brookhaven National Laboratory and the operation of the AEC's New Brunswick Analytical Laboratory. His responsibilities also included administration of production at Mallinckrodt, the Feed Materials Production Center at Fernald, and other sites.

WILBUR E. KELLEY

New Opportunity for Uranium Men

1, 1959. An earlier statement had specified July 1958 for initiation of deliveries. Proposals must be received by October 1, 1956.

This decision by the AEC to integrate raw and feed materials is to be commended as sound and shows a great deal of foresight. It should have a significant and increasing effect on the location, size and methods of operation of new and existing uranium ore-processing mills.

Many aspects of this subject are still incompletely defined. Apparently, the AEC is interested in providing industry with wide latitude in order to obtain comprehensive and well-considered proposals. The implications of these proposals on possible future participation by industry in other areas of atomic energy are obvious.

Technology, specifications and capacities of uranium feed materials plants are intimately related to all other areas of the nuclear industry, including raw materials.

Here's a quick review of what has been going on in production of feed materials and what it means to you.

How to Process U_3O_8 Concentrates

Major operations involved in the production of AEC specification grade uranium metal from ore concentrates at Fernald are illustrated in flow sheet above with corresponding chemical reactions.

Ore concentrates are received in drums. To comply with AEC requirements, rigid uranium accountability must be practiced. A sampling plant performs these operations after which the concentrate is sent to a digestion unit where it is contacted with nitric acid to form an aqueous solution of uranyl nitrate. This uranium solution, without prior filtration, is sent to a liquid-liquid extraction unit where an organic phase of tributyl phosphate in kerosene selectively removes the uranium from the aqueous slurry. The uranium is then re-extracted into water in a stripping unit, producing a highly purified aqueous uranium solution. Equipment used for this extraction of uranium from aqueous slurries consists of sieve-plate pulse columns at Fernald. Pulse columns which were developed in atomic energy work are exceptionally well suited for handling most ores.

At this stage the highest purity is achieved. Limits for contamination at this point are rigidly set, since the subsequent processing operation results in some slight unavoidable product contamination. The highly purified uranium is recovered in a dilute solution form that is then evaporated to form uranyl nitrate hexahydrate (UNH). This then undergoes thermal decomposition (denitration) to form uranium trioxide (orange oxide). These operations have been performed in a number of installations. The processing and manufacturing techniques are known with a great deal of certainty.

Next step in the production of uranium compounds is formation of uranium tetrafluoride or "green salt" (UF_4). Purified uranium trioxide or "orange oxide" (UO_3) is reduced by hydrogen to form uranium dioxide or "brown oxide" (UO_2). The uranium dioxide is contacted with gaseous hy-

drogen fluoride to form uranium tetrafluoride. Water vapor is evolved.

Uranium tetrafluoride produced in this operation is packaged and can take two alternate courses. One leads to metallic uranium for reactor fuel elements. The second course is to ship the uranium tetrafluoride to the Commission's gaseous diffusion plants for conversion to uranium hexafluoride (UF_6). Here the small amount of fissionable U^{235} present in naturally occurring uranium is removed from non-fissionable U^{238}.

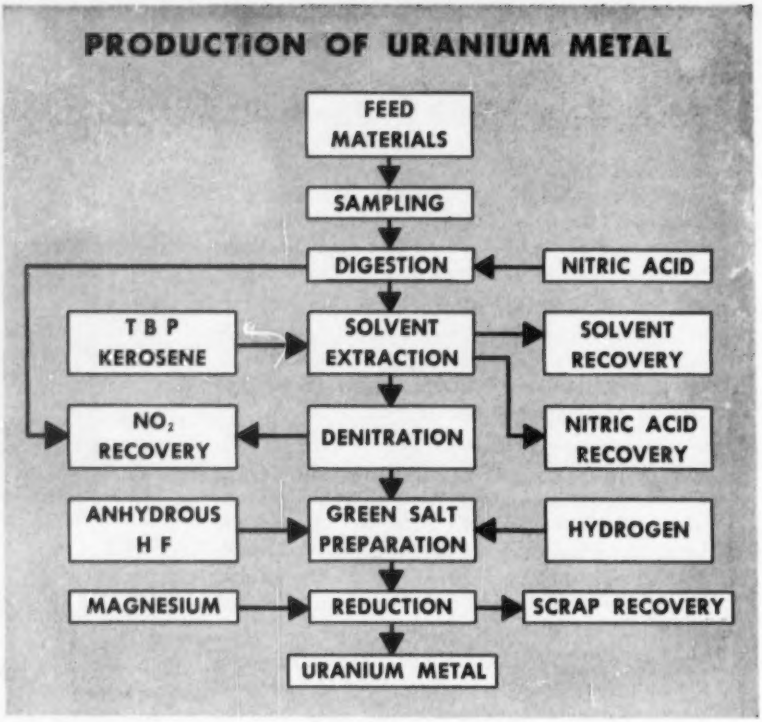
To make metal, uranium tetrafluoride is mixed with magnesium metal and the mixture is packed into individual containers ("bombs"). The contents are then heated to the point where a thermit-type reaction takes place. A uranium metal "derby" and a slag containing magnesium fluoride are formed. The metal is separated by mechanical methods and is then consolidated into a uranium ingot by vacuum casting. Ingots are subsequently rolled and machined in a metal fabrication plant to form slugs. These constitute the final product at Fernald and are sent to Hanford or Savannah River for canning.

In the various stages of manufacture, uranium wastes and residues are produced. These materials are processed to recover their uranium values and to produce waste which can be safely discarded. This operation is carried out in a scrap plant.

Function of the scrap plant is to recover a high grade uranium concentrate of low halogen content from process scrap materials produced in the green salt and metal production operations. Scrap includes slag, bomb liner and derby chippings from the bomb reductions, and broken molds and crucibles from remelt operations. The concentrate is returned to the refinery for purification.

Auxiliary processes to the above operations are a sump system designed to recover uranium in spilled materials and a system for recovering concentrated nitric acid from waste nitrous gases and from dilute aqueous acid streams.

In the recovery of uranium from the mixture of ore concentrates and nitric acid, a waste solution is produced from which the nitric acid is recovered. The recovery of this acid results in lower over-all chemical costs and prevents stream pollution.



The installation recently completed by the Catalytic Construction Co. for Eldorado Mining and Refining, Ltd., at Port Hope, Ontario, utilizes the same over-all process as Fernald. Final product from the Eldorado facility is uranium trioxide.

To appreciate the achievements, shortcomings and future possibilities of feed materials processing to date let's examine its brief period of development.

Evolution of Feed Materials Technology

The atomic energy industry was born during the hectic war years with improvised, frantic, dispersed and often relatively inefficient investigations. The current status of uranium feed materials technology has been largely determined by its evolution over the past 15 years; during the war under the OSRD, later the Corps of Engineers, and up to the present under the AEC. Over the decade since the war, the atomic program has remained a highly classified Government monopoly. In the past, there has been relatively little incentive for private industrial participation because of legal restrictions and Government regulations.

"Uranium technology and, in fact, well over 95% of what has been labeled 'nuclear engineering,' are still inherently comprised of the same basic technology with which industry is familiar."

1. Nuclear Engineering

There is no doubt that nuclear reactors, gaseous diffusion and other operations, such as handling highly radioactive fuels and wastes, involve some problems unlike those encountered by industry before. On the other hand, most chemical and physical operations in atomic energy do not involve problems very different or any more difficult than the average found in the chemical, petroleum and metallurgical fields. There are, of course, certain characteristic problems in uranium feed materials technology, such as large variations in concentrate composition, accountability, health-safety and somewhat arbitrary product specifications.

But comparable problems are found in engineering, construction and operation of such varied fields as petroleum derivatives, ammonia, titanium, and organic and inorganic chemicals. It is not at all uncommon to have purity specifications for petroleum catalysts on the order of several parts per billion. Elevated temperatures, corrosive conditions and the use of hydrogen fluoride and halogens are quite common in petroleum, metallurgical and chemical operations.

BASIC CHEMICAL REACTIONS

DISSOLUTION

1. $U_3O_8 + 8HNO_3 \rightarrow 3UO_2(NO_3)_2 + 2NO_2 + 4H_2O$

EXTRACTION

2. $UO_2(NO_3)_2 \cdot 6H_2O + 2(C_4H_9O)_3 \cdot PO \xrightarrow{HNO_3}$
(TBP) $UO_2(NO_3)_2 \cdot 2(C_4H_9O)_3 \cdot PO + 6H_2O$
(U-TBP COMPLEX)

RE-EXTRACTION

3. $UO_2(NO_3)_2 \cdot 2(C_4H_9O)_3 \cdot PO + 6H_2O \rightarrow$
$UO_2(NO_3)_2 \cdot 6H_2O + 2(C_4H_9O)_3 \cdot PO$

DE-NITRATION

4. $UO_2(NO_3)_2 \cdot 6H_2O \rightarrow UO_3$ (ORANGE OXIDE) $+ 2NO_2 + \frac{1}{2}O_2 + 6H_2O$

REDUCTION TO BROWN OXIDE

5. $UO_3 + H_2 \rightarrow UO_2$ (BROWN OXIDE) $+ H_2O$

HYDROFLUORINATION

6. $UO_2 + 4HF \rightarrow UF_4$ (GREEN SALT) $+ 2H_2O$

REDUCTION TO METAL

7. $UF_4 + 2Mg \rightarrow U$ (METAL) $+ 2MgF_2$

Uranium technology and, in fact, well over 95% of what has been labeled "nuclear engineering," are still inherently comprised of the same basic technology with which industry is very familiar.

Normal industrial processing techniques are constantly changing to meet competition. The industrial philosophy of constant, objective review and willingness to revamp or even scrap entire plants, when processes are obsolete, will eventually have to be adopted for all non-weapons operations in the atomic industry. Many operations currently used in uranium feed materials, for all practical purposes, have been "frozen" over the past decade. Many of these could be greatly improved or shown to be obsolete.

2. Metal Production

Converting uranium-containing ores to uranium metal requires a series of steps similar to those used for various non-ferrous metals: preliminary ore concentration; digestion of concentrate to solubilize uranium; purification by solvent extraction or successive precipitations and dissolutions; conversion to an intermediate compound that can be reduced to metal by batch reduction or electrolytic means; remelting; casting and rolling, or extrusion, into desired shapes.

Under wartime conditions it was highly desirable to have the chemical processing chain pass through uranium tetrafluoride which could yield either metal (by reduction) or uranium hexafluoride (by fluorine treatment). This permitted the scarce uranium to be routed either to a reactor or to a diffusion plant.

During 1943, metal production by magnesium reduction was expanded and the method was chosen as best for large-scale operations. Calcium reduction was studied but not adopted. The supply of distilled calcium was not adequate for the anticipated demand. Another disadvantage was the relatively high cost of pure calcium. Direct reduction of the oxide was not adopted because calcium is needed for this reaction.

Green salt (uranium tetrafluoride) was originally produced in batch tray units. The batch process was subsequently replaced by continuous processes.

Production of uranium metal by reduction of UF_4 with magnesium by a simple batch reduction which was initiated at several locations.

"Uranium chemistry is very similar to that of such metals as zirconium, thorium and titanium."

3. Production Plants

Following the war, production of uranium metal was centralized at Mallinckrodt. In 1947 the AEC started work on new facilities. All available data and ideas on producing tonnage amounts of uranium metal to rigid product specifications were incorporated. Operations had to be flexible enough to handle a variety of foreign and domestic ores.

The process was essentially the same one used today, except for certain simplifications and economies. Tributyl phosphate, with kerosene as diluent, is used at the Fernald Feed Materials Production Center, for the liquid-liquid extraction process. Ethyl ether is still used as the organic solvent at Mallinckrodt.

In 1950 work started on the new feed materials plant at Fernald, Ohio. This plant is currently being expanded. A new feed materials plant is also being erected at Weldon Springs, near St. Louis, Mo. The processing scheme for both the Fernald expansion and the Weldon Springs plant will be essentially the same as that in the present Fernald facility.

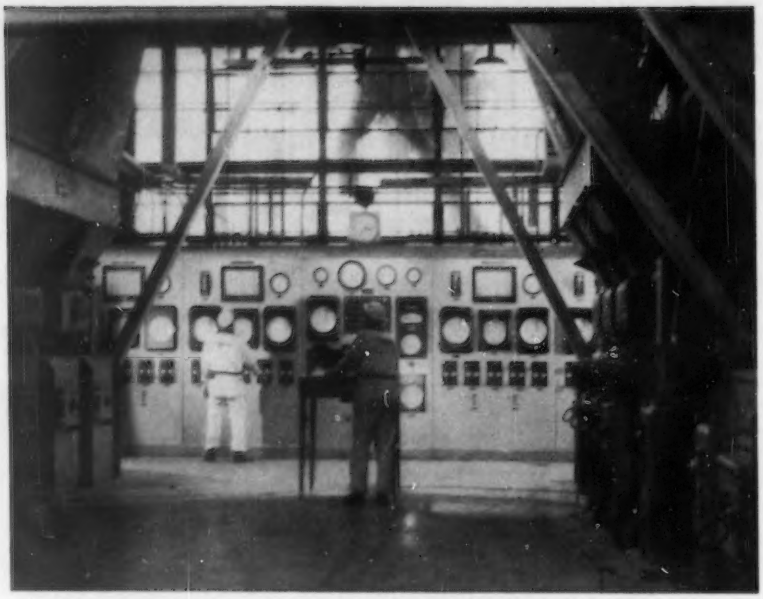
From the above, it is apparent that the manner in which uranium containing raw materials are converted into slugs of uranium metal suitable for loading into a nuclear reactor or into pure uranium hexafluoride for a gaseous diffusion isotope separation unit, has undergone no fundamental change since 1944. This is the case, although the early decisions as to processing sequence were made under severe time pressure and many of the circumstances which greatly influenced these early decisions do not now exist.

Future Feed Materials Developments

Uranium chemistry is very similar to that of such metals as zirconium, thorium and titanium. It is not surprising that processing routes used for these metals should also have been investigated for possible application to uranium production.

Various processing schemes for these metals have been suggested and many have been studied experimentally, including: electrolytic reduction using molten salt baths; vapor phase reduction of metal halides with sodium

" . . . The manner in which uranium-containing raw materials are converted into . . . metal . . . or pure uranium hexafluoride, has undergone no fundamental change since 1944 . . . although circumstances which greatly influenced early decisions, do not now exist."



"WHAT WILL BECOME OF the Feed Material Production Center at Fernald, Ohio, (above) now operated for AEC by National Lead Co., when private industry gets into production of feed materials?," is one question that Mr. Kelley does not cover herewith.

vapor; direct oxide reduction with calcium, magnesium or carbon; electrical discharge techniques; low temperature methods; direct halogenation of ores or concentrates; and bomb reduction of metal halides with magnesium, calcium or sodium, using modified Kroll processes.

The uranium reduction process now used is also, in effect, a modified Kroll technique. It is very similar to the method still used for zirconium and titanium, except that the UF_4 is reduced with magnesium, whereas $TiCl_4$ is reduced with either sodium or magnesium in the titanium plants built to date.

There is fairly general agreement in industry that, in the near future, the batch Kroll process for the tonnage-scale production of titanium will be supplanted by one or more continuous methods. The same should be true in the case of uranium production.

No doubt considerable simplifications and savings could be effected in many of the chemical and metallurgical operations for uranium production. Considerable work is underway on such improvements at several AEC sites—all on a classified basis.

With normal commercial incentives, the following are typical of the cost-saving, new and improved processes which could be developed.

1. **Thermal decomposition** of uranium nitrates, and the metal nitrates in the raffinate stream after uranium extraction could be greatly simplified by new continuous processes. Overhead gases containing nitrogen oxides would be directly reused for ore digestion without prior formation of nitric acid.

2. **Moving bed type** of operation is ideally suited for conversion of UO_3 to UO_2 and UF_4 and has long been used for comparable duties in the petroleum industry.

3. **Using much larger bombs** and developing continuous reduction methods for converting UF_4 to metal offer attractive possibilities.

4. **Substituting powder metallurgy** for the present metal-fabrication facility becomes particularly promising when one considers the potentials for direct, simultaneous pressing and canning, and improved fuel behavior under thermal cycling. The present rolling mill would be completely unsuitable for shapes other than cylindrical.

5. **New techniques of solvent extraction** and ion exchange should be carefully investigated for each new or revamped mill.

6. **Completely new processing routes** offer many potential technical and economic advantages. For example: Direct halogenation of ores or concentrates, with purification by fractionation of volatile halides as practiced in the titanium industry, could supplant solvent extraction. However, it should be emphasized that further research and development are required before such new processes are ready for definite design.

7. **Combining directly raw materials and feed materials operations** in one plant is particularly attractive. The refined product may be carried to any one of several forms, such as UO_3, UF_4, metal or UF_6, depending on contractual arrangements with the AEC. Adequate data are available to permit the design at this time of a combined raw and feed materials facility, incorporating many important process improvements.

"A great deal must be done still to integrate uranium technology in the same way non-ferrous metals such as copper and aluminum are integrated."

Why Integrate Raw and Feed Materials?

Operations in raw materials, feed materials, fuel reprocessing and waste disposal have become excessively compartmentalized in the past. This had led to a general failure of those involved in one field, including even top-echelon industry and Government officials, to appreciate adequately the problems, economics and requirements of the others. It would be difficult to overemphasize the importance of closely integrating all these critical phases.

Private industry discussions and proposals for erecting and operating raw materials plants on one end of the chain, and power reactors and irradiated-fuel processing plants on the other are illogical and inconsistent if one accepts as permanent the concept of government-built-and-operated feed materials plants.

Many estimates of power costs have been and are being made and it would be an understatement to say that they vary widely. It is difficult to see how these can be very realistic without taking into account the future of the feed materials operations. It is hardly sound industrial practice for us to assume that the government will indefinitely take responsibility for such operations.

Those who have made over-all studies of nuclear-power economics must be struck with the difficulty of determining reliable costs while the resulting artificial and indefinite price situa-

tion exists. It is mandatory that the entire problem be viewed as an integrated operation similar to the current commercial production of chemicals and power. It is inevitable that, if industry is to assume full responsibility in ore exploration and processing, power application and even fuel and waste reprocessing, private industry must have complete responsibility for what is now called feed materials. The entire processing route will have to be integrated.

Information released on raw materials makes it apparent that while much has been accomplished, a great deal must still be done to integrate uranium technology in the same way non-ferrous metals such as copper and aluminum are integrated.

The bases of private industrial participation in feed materials may be arbitrarily grouped into three categories:

1. Plant to purchase concentrates and sell refined salts or other uranium products back to the AEC.

2. Plant adjacent to a concentrate-producing mill for the purpose of furnishing a refined product for sale to the AEC.

3. Plant such as Item No. 2, but designed to process additional ore concentrates from other mills on a custom basis.

The above applies to completely new facilities as well as those already in operation or under construction.

Studies are currently being conducted on all of these possibilities by various organizations. The problem is somewhat complicated by the fact that the AEC is still the only customer for all possible products from the refinery. This involves the usual requirements of product price negotiations with the Commission.

Even if security restrictions permitted, it is doubtful that actual investment and operating costs for existing feed materials facilities will have much significance for a plant to be built and operated by private industry. Undoubtedly, a privately-owned facility, regardless of which of the above bases are involved, will bear little resemblance to existing installations.

For one thing, considerable savings in both investment and operating costs, over existing Government-owned facilities, can be achieved by having the entire engineering, procurement, construction and operation conducted by normal, competitive, industrial practice.

Then too, an obvious advantage of integrating raw and feed materials at a given site is the resultant simplification of the over-all process. Aqueous streams containing uranium from ion exchange or solvent extraction stripping operations in the ore concentrating mill would flow directly to the adjacent refinery without prior precipitation of uranium values.

"The uranium reduction process now used is also, in effect, a modified Kroll technique."

This liquid stream would be evaporated to the desired concentration, necessary chemical ingredients added, and the solution fed to the tributyl phosphate, solvent extraction operation described above. The nature of the final product, whether UO_3, UF_4, or UF_6, would hinge on AEC negotiations.

This procedure would eliminate some of the mill operations in the final stages of ore concentration, including precipitation from stripping liquor, drying and packaging of the U_3O_8 concentrate.

In addition, the feed materials chain of operations would be simplified beyond that discussed earlier. Operations such as crushing, sampling and digestion of ore concentrates would be eliminated. This would provide appreciable reductions in overall investment and operating costs.

Of course, if such a facility handles additional ore concentrates from other mills, appropriate crushing, sampling and digestion will be needed for that portion of the refinery feed.

New Fields for Uranium Millers

Most of the operations involved in feed materials processes such as evaporation, mixing, crushing, grinding, precipitation, pelletizing and reduction are not new to the extractive metallurgy field. A few of the operations, such as solvent extraction and hydrofluorination, may be unfamiliar to some of the metallurgical industries. While equipment designs for these operations may vary because of the characteristic properties of materials, scale of operations, purity specifications, etc., there is nothing essentially new about the processes in the chemical and petroleum fields.

Engineers entering feed material processing should make themselves familiar with properties of the compounds involved in these operations. (Further details from unclassified sources are available from "The Chemistry of Uranium" by Katz & Rabinowitch, and "Encyclopedia of Chemical Technology" by Kirk & Othmer. A large amount of data on chemical and physical properties are still classified.)

Uranyl Nitrate—$[UO_2(NO_3)_2 \cdot 6H_2O]$ —Mol. Wt.—502.18.

This is the most important of the water soluble compounds of uranium, forming three well-characterized hydrates containing two, three and six molecules of water. The hexahydrate is obtained by crystallization from water and dilute nitric acid.

Its solubility in organic solvents is probably its most important characteristic. While the solubility in ethyl ether has been known for a very long time, use of solvents such as tributyl phosphate and methyl isobutyl ketone are relatively recent developments.

Uranium Trioxide—(UO_3) Mol. Wt.—286.07.

This oxide is obtained by thermal decomposition of either uranyl nitrate or ammonium diuranate ($(NH_4)_2 U_2O_7$).

In spite of very extensive studies on uranium oxides and hydrates of these oxides, there is still much about them that is not well understood. Differences in such factors as crystal size and the many allotropic modifications of these compounds have a tremendous effect on physical and chemical properties.

Uranium Dioxide—(UO_2) Mol. Wt.—270.07.

This oxide is an intermediate compound formed in conversion of UO_3 to UF_4.

Uranium Tetrafluoride—(UF_4) Mol. Wt.—314.07.

This salt is not soluble in water and is not appreciably hydroscopic. It is essentially non-volatile although it can be sublimed under vacuum at temperatures on the order of 2,000 deg F.

A huge amount of work has been reported on the preparation, reduction and properties of this compound. In general, it is a stable, relatively inert salt. Its physical properties are similar to other quadrivalent metal fluorides, particularly such isomorphous compounds as ZrF_4, ThF_4, and HfF_4. Chemical differences are due primarily to the fact that uranium can exist in different valence states, whereas the other elements are exclusively quadrivalent in their fluorides.

(Please turn page.)

"The atomic industry of the future will thrive and be developed to its full potential only when it is fully released to normal competitive, industrial practice."

FEED MATERIALS— New Opportunity In Uranium

Uranium Hexafluoride—(UF_6) Mol. Wt.—352.07.

This is a colorless compound in the liquid and gaseous states. It is the only known stable, gaseous compound of uranium. It sublimes at atmospheric pressure at 56.54 deg C and has a triple point at 64.02 deg C at 1134 mm Hg. Thus there is no liquid phase except at pressures above atmospheric. UF_6 is generally prepared by direct fluorination of UF_4. It is a highly reactive compound and involves problems in handling. For instance, it must be protected against water, with which it reacts vigorously to form uranyl fluoride (UO_2F_2) and HF.

Despite its high molecular weight, the properties of the vapor approximate those of an ideal gas. Although it is very reactive, there is a great deal of experience and know-how available on its properties and precautions for safe handling.

Hydrogen Fluoride

This is a colorless gas or liquid, forming colorless solutions with water in all proportions. Aqueous solutions down to about 70% HF fume greatly; lower acid contents do not fume excessively. The fumes are extremely corrosive and dangerous to inhale. Contact with the skin causes severe, slowly healing burns; vapor inhalation can be fatal. Nevertheless, hydrogen fluoride and its solutions are shipped and handled extensively and safely in tank cars as well as drum quantities.

Many grades are available commercially, including 30, 48, 52, 60 and 70%, as well as anhydrous. Aqueous solutions: 60 and 70% acids are shipped in 20-, 55- and 110-gallon steel drums and in steel tank cars containing about 30 tons of acid; 30-52% acids are shipped in rubber-lined drums and small plastic bottles; some acids below 70% are also shipped in lead carboys; anhydrous HF is shipped in steel cylinders and in forged steel tank cars (containing 23,000, 43,000 or 83,000 pounds of HF). The usual precautions observed in handling compressed gases should be taken.

Years of experience in manufacture and use of HF have shown that it can be handled with relative safety, provided proper precautions are taken. In addition to the extensive use of HF in the AEC program, there have been increasing and varied industrial applications: in the petroleum industry as an alkylation catalyst; for production of inorganic fluorides such as those of sodium and antimony; for glass etching and polishing; for production of fluorinated hydrocarbons such as freon compounds; and for other organics such as Teflon and Kel-F.

Steel has been used for many years for HF generators. Lines and other equipment can be made of steel as long as acid condensed from these gases is greater than 70% HF. Weaker solutions require non-ferrous materials such as carbon, lead, bronze or monel.

In the liquid state, hydrogen fluoride probably exists as a hexamer at normal temperatures. The approximate molecular weight of gas in equilibrium with liquid at —35 deg C is 86 compared to a molecular weight of 20 for the monomer. Considerable heat effects are involved in the breakdown of these polymers, as is shown by the high apparent heat capacity of the gas due to depolymerization as the temperature increases. Oddly enough, although HF is extremely reactive it forms relatively weak acids in aqueous solutions.

Fluorine—(F_2) Mol. Wt.—38.00.

Fluorine is required for the conversion of UF_4 to UF_6. The technology involved in this process has not been declassified by the AEC.

Fluorine exists as a pale, greenish-yellow gas, as a canary-yellow liquid and as a light yellow solid; m.p., —217.8 deg C; b.p., —188 deg C. It is the most reactive chemical element, reacting vigorously with most oxidizable substances at room temperature, often with immediate ignition. Even in very small amounts in air it has an intense, very irritating odor, somewhat similar to chlorine and ozone.

Prior to World War II, fluorine was available only in very small quantities. The atomic energy program resulted in developments which now make it available at reasonable cost.

Metals are generally attacked by fluorine at normal temperatures, although many of them form protective fluoride coatings which effectively resist further attack. Al, Fe, Cr, and Ni all form protective films in the cold, but react vigorously if heated; Pb reacts vigorously in the cold; Cu and Au are attacked only at high temperatures. In general, monel, aluminum, magnesium and nickel are the most satisfactory metals. Few other materials, except metal fluorides in their highest valence state, are unreactive with fluorine.

In the handling of fluorine, all equipment in contact with it must be completely dry. All traces of metal filings, oxides, dirt, oil, grease and other organics should be eliminated. Where the formation of a fluoride scale must be avoided and in high pressure work, nickel alloys are recommended.

Most of the fluorine utilized by industry is generated at the point of utilization, if at all possible. It can be shipped in steel cylinders at 400 psi.

Health hazards of fluorine in the atmosphere are at least as serious as those for chlorine. Fluorine causes burns similar to HF. Protective measures are probably still not fully developed.

Fluorine is generated at about atmospheric pressure and can usually be handled safely in iron pipes at that pressure. Piping, valves, instruments, compressors, and other equipment for fluorine must be selected with care for safe and economical handling, particularly at high pressure.

The storage of fluorine can present hazards, particularly when large quantities are involved. Storage of the compressed gas is feasible if proper care is taken. It is fairly common to store as much as 200 pounds of the gas in one container at 30 psig, if adequate precautions are taken. For maximum safety, nickel or monel are recommended for cylinders.

Conclusion

The atomic industry of the future will thrive and be developed to its full potential only when it is fully released to normal, competitive, industrial practice. This can be done without in any way jeopardizing areas of valid security related to military applications. The alternative is not only to lose whatever margin of advance technology we may have over other nations, but possibly to be outstripped by them.

The next several decades may well see changes and developments in the atomic field as drastic and revolutionary as those of the past decade. Opportunities will materialize for many new industries, including suppliers of vital feed materals required in reactors and associated facilities. An objective and integrated approach to the entire field by private industry is not only desirable but mandatory.

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PROBLEM HERE WAS TO FILL across track shown at center right without interrupting mine freight traffic.

SOLUTION WAS to build a synthetic concrete tunnel and fill over it. Top track is used to haul waste from pit to dump.

Traffic Shutdowns Averted By "Synthetic" Tunnel at Morenci

DAVID H. ORR JR.
Phelps Dodge Corp.
Morenci, Arizona

PHELPS DODGE CORP.'s personnel at Morenci Branch recently completed an unusual tunnel construction—unusual because the 324-ft reinforced concrete tunnel was constructed first and then buried under 60 ft of fill. See illustration of completed tunnel prior to earth enclosure. Note that the completed "synthetic" tunnel included wing and parapet walls at the portals.

The structure was built as part of a project to construct a double track railroad grade to a new disposal area for waste rock from Morenci Branch's open pit copper mine. To reach the new disposal area, trackage had to be extended across Morenci Canyon adjacent to the primary crushing plant. Situated in the canyon about 60 ft below the track elevation at the crushing plant is a section of single track over which all mine-bound railroad freight is hauled. Relocation of this track section, or even closing it during the construction period, was considered to be impractical. The two new haulage tracks had to be carried over the mine service track, crossing it at an angle of about 45 deg.

To construct the haulage tracks it was necessary to realign the tailtrack from the crushing plant dumping pocket to parallel them. In so doing it also would extend across the service track. Reduced to its simplest terms, the problem was how to carry three tracks across and 60 ft above an existing track without closing that track for periods longer than 8 hours. The unique precast tunnel method of protecting the service track was chosen from a total of five possible solutions. It was felt that Morenci Branch's construction crews could erect this type of structure more rapidly than any of the other four considered and at a lower cost.

Prefab Method Cuts Cost

Actual construction work, from the time that footing excavation began to completion of the structure, required just under four months. A total of 1,475 cu yd of concrete was placed, of which 966 cu yd went into the precast arch sections. Its completed cost was 15% below the estimated cost of forming and pouring the tunnel in place.

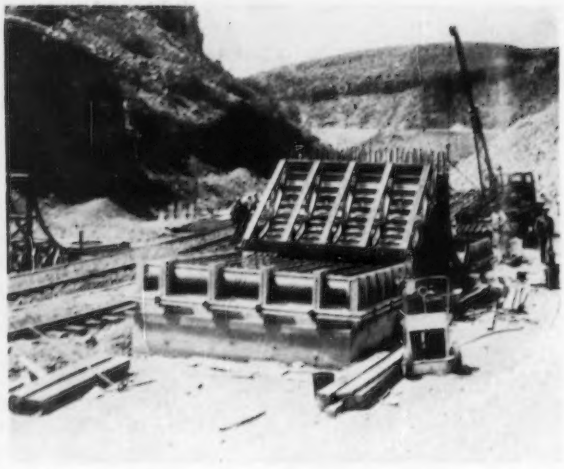
A reinforced concrete footing consisting of two longitudinal members with transverse spreaders at 12-ft intervals was poured in place. Cast into each of the two longitudinal members was a channel cut from 16-in. pipe to receive the 15-in. diameter bullnose cast on the base of each half-arch section. After completion of the footing, ballast was placed over the spreaders between longitudinal members. The tunnel track, which was to replace a section of the nearby service track to the mine, was then laid along the footing's centerline.

Before the pouring of the footing was completed forming of two casting beds was underway about 50 ft away from the position of the south portal. Constructed of concrete and structural steel each was designed to permit the pouring of one 12-ft section of tunnel in two halves. To obtain the arch contour both the extrados (outside curve) and intrados (inside curve) forms were built of ½-in. plywood supported by structural steel frames. The concrete slab portions of each casting bed served as the forms for the tunnel sidewalls.

Erection of the precast tunnel sections, using a railroad crane, began at the north portal position and progressed toward the south portal. Before the first section was set in place one of the north portal wing walls was poured. After six arch sections had been placed, forming of the other wing wall and the parapet wall was begun. Before the last of the 27 sections had been placed, the north portal structure and one of the wing walls at the south portal were completed (construction of the other wing wall was purposely postponed to allow clearance for swinging the last arch section into position).

Following erection of the last section forming and pouring of the one

NEW TRACK WAS LAID along footing centerline for the synthetic tunnel to replace old freight track section at right.



INSIDE FORMS used for prefabricated tunnel sections. Cages of shop-fabricated reinforcing bars are placed by truck crane.

remaining wing wall and the parapet wall at the south portal began. A moisture-resisting compound was applied to those surfaces of the tunnel that were to be in contact with the backfill material. When the forms were removed from the south portal structure it was painted, thus completing the synthetic tunnel construction.

Five different structures were considered—two types of bridges and three types of protective cover for the service track. The protective cover or tunnel schemes were actually three different methods of satisfying a single idea.

Adjacent to the primary crushing plant was an old fill extending beyond the centerline of the canyon. The designers opposed constructing one of the two main piers for a bridge on this fill while the other would be situated on solid ground. Moving the pier back sufficiently to permit excavation to solid ground could have been made, for its placement resulted in a 200-ft increase in clear span, bringing the total span to 420 ft. To accommodate three tracks and a one-lane roadway for automotive equipment a minimum deck width of 54 ft would have been required. This was the most expensive of the five designs considered.

Abutments 60 ft high either side of the service track with a plate girder span between were rejected. Bringing fill up to the abutments would have demanded that they be designed as excessively high retaining walls with long wings to retain the fill slopes. Even if struts were set between the abutments to cancel the fill pressures acting against each, the forming and pouring task would have been quite difficult.

A culvert-like structure over the track designed to permit carrying a fill completely across the canyon appeared to be the most desirable solution. Upon investigation it was learned that no corrugated steel multiplate section is yet manufactured that will provide clearance for any piece of standard railway rolling stock. The use of structural steel was almost adopted; however, it was doubted that it could be completely protected against corrosion for its minimum service life. Once backfilled the structure would be continuously in contact with mildly acid earth, with no opportunity to repaint when the original application began to deteriorate.

A reinforced concrete tunnel to be formed and poured in place appeared undesirable because it presented a costly forming operation, and, due to its heavy reinforcement, a very difficult concrete placement job.

Precasting Proves Best

Precasting the arch sections in halves was adopted because it reduced formwork to a minimum and, at the same time, facilitated pouring low-slump concrete for maximum density. Aside from being much more difficult to precast, a full arch section's weight would have exceeded the capacity of any of the locally-available cranes. The use of an additive to induce high early strength permitted the lifting and erection of the arch sections 48 hours after they were poured. Because of this measure it was possible to erect the 27 sections in 54 working days. Only the footing and the wing and parapet walls at the portals were cast in place.

After careful consideration of all types of standard arch sections, the 3-hinged arch was chosen as being best adapted to the construction method contemplated. Hinge points were designed at the bases and the crown. To provide for hinge action the arch bases were constructed with a 15-in. diameter bullnose. When erected, the bullnose rested in a channel cut from 16-in. pipe mounted in the foundation. Hinge action at the crown was created by crossing and lap welding transverse reinforcing bars projecting from the half-arch sections. The space containing the lapped bars was then grouted to prevent entry of fill material.

Much study and discussion was devoted to the determination of the earth pressures to which such a structure may be subjected. Published data on the subject, representing research work done at Iowa State College, the University of North Carolina, and by the American Railway Engineering Association, deal primarily with comparatively small round pipe conduits. Correlating data obtained on such cross-sections to a large arch-shaped section presented some interesting problems. An added complication in this connection was whether to consider this particular "conduit" as being rigid or flexible, as there is considerable difference in the distribution of earth pressures around the periphery of the two types. To minimize the effect of this difference the decision was made to compact the backfill material for a distance of at least five feet around its walls and crown.

Two casting setups were provided near the south portal of the tunnel. The setups were built on opposite sides of the track entering the tunnel so that a railroad crane could be used to lift the precast half-arch sections. Each was designed to permit the simultaneous pouring of two half sections. The use of two casting setups elimi-

RAILROAD CRANES swing two 35-ton steel-reinforced 12-ft half sections of precast concrete tunnel lining onto footings.

PARTIALLY COMPLETED tunnel showing arch sections, parapet wall and wing wall at portal. Next step was filling.

nated delays waiting for the concrete to cure sufficiently to permit lifting the sections. While one set of sections was being stripped, lifted and set in place, another set was being poured. Surfaces of the forms were coated before each pour with a commercial bond-breaker compound. As a result, no difficulty was experienced due to adhesion or vacuum in lifting the 35-ton half sections off the casting beds.

Concrete was transported to the site in Dumpcretes from the company's central mixing plant located about a mile distant. For this project the maximum permissible slump was specified at 3 in. A 6-sack mix designed for a 28-day compressive strength of 4,000 psi was used. By actual test the average of the 28-day strengths exceeded 4,600 psi. An additive to induce high early strength was used so that the sections could be lifted 48 hours after pouring. It was specified that no lifting be done until a strength of 2,000 psi was attained. The 2-day test cylinders made to check compliance with this specification averaged better than 2,200 psi.

A 40-ton self-propelled railroad crane with a flat car was used to lift, transport and erect the half-arch sections. In the erection of the first two halves two cranes were used, as there was nothing to support one-half while its mate was being set in position; however, with the first pair in place, a crown spreader frame was used to eliminate the need for the second crane. Anchored in the 18-in. space at the crown of an erected full arch section, this frame provided a support for one-half of the next section while the crane was placing the other half.

Special heavy-duty lifting inserts were cast in each half-arch section at positions symmetrical about the center of gravity as determined by the insert manufacturer. Two sets of pickup points were required in each half section. One 4-point set was used to attach slings for the lift off the casting bed. The half section was then rested on a flat car and the slings removed. A 3-point set on the outside arc or extrados of the arch was next utilized to attach a bail for lifting the half section into an erect position for placement on the tunnel footing.

Sections Weigh 35 Tons

As cast each half section weighed 35 tons. The 40-ton crane employed could safely handle that load only when carrying it with a high boom angle and with its outriggers securely blocked. Half sections were transported from the casting site to their erection position on the flat car pulled by the crane. No attempt was made to travel with one suspended from the boom.

Erection of the 27 full arch sections required just 54 working days. Each section was cast ¼-in. shorter than 12 ft to prevent any material increase in the structure's total length should any of them have failed to butt perfectly. This precaution resulted in a completed structure just 4 in. longer than its designed length, the average clearance at the 26 butt joints being about ⅛-in.

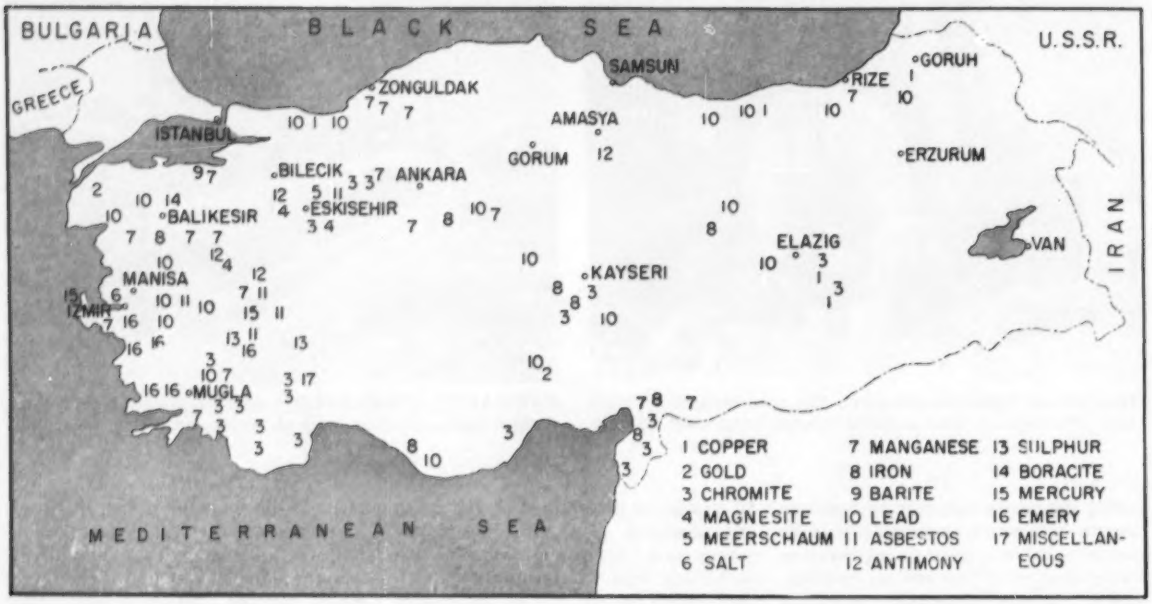
After each section was erected, crossed reinforcing bars in the 18-in. space at the crown were lap welded to form the crown hinge. A series of point connections between the half-arch section were thus formed. These point connections simulate a piano hinge extending the full length of the structure at its crown.

To protect the concrete from any possible disintegrating influence all surfaces of the synthetic tunnel that were to be in contact with the backfill material were painted with a bituminous waterproofing compound. The compound selected contains a hydrophilic agent which permits its application over green concrete. Because of this quality, application of the coating followed closely behind the erection of the arch sections.

Backfilling over the completed structure was accomplished in three stages. First a fill of selected material was placed around the tunnel walls to a height of five ft above its crown. This selected fill was placed in 6- to 12-in. layers by means of 25-ton dump trucks and a bulldozer. Each layer was thoroughly sprinkled with water and repeatedly rolled by the truck tires to obtain adequate compaction. The compacted fill served as a shock absorber for the second and third stages of backfilling. In the second stage trucks placed material loaded from the nearby dump to create a fill 40 ft wide spanning the canyon at the established grade of the projected haulage tracks. The third stage—that of widening the fill to its ultimate width—consisted of dumping waste rock from railroad cars operating on a track laid across the truck fill.

The entire project, from site preparation for the synthetic tunnel to completion of the railroad tracks above, was accomplished in a period of 9 months. All work was done by regular Morenci Branch crews with no increase in personnel to handle the project. Construction of the tunnel structure required about four months.

Appreciation is expressed to the management of Phelps Dodge Corp. for their guidance and counsel during accomplishment of the project and for permission to publish this paper.



MINERAL DEPOSITS are scattered across the country, with preponderance in the eastern sections. A great deal of Turkey's potential is still unknown, but a favorable climate for foreign investment is expected to encourage more exploration.

Turkey's Mineral Potential Expands

H. FERID KROMER

Consulting Mining Engineer

FOREIGN CAPITAL is recognized to have the same rights as local investors in Turkey, a mining nation which is making a successful approach to wealth and stability. New mining and petroleum laws permit the sending of profits and other income and capital out of the country without restriction. Turkey's democratic government realized, after an unsuccessful attempt to develop the country's resources without foreign capital in 1950, that it needed friendly investors to expand and grow.

The wisdom of the government's change of attitude is being proved with new production and greater exploration, to the benefit of the nation and the investor, who goes where the climate for his capital is good.

Leading minerals in volume in 1954 included: iron ore (586,205 metric tons); chrome ore (561,549 metric tons); manganese (49,827); copper (24,532), and boracite (14,331). Last named is "a borate and chloride of magnesium, $Mg_7Cl_2B_{16}O_{30}$. It is strongly pyroelectric."

Iron ore: Most important iron ore deposits are in Divrik, in eastern Turkey, where reserves are said to equal 35-million tons. Ore is divided into two types, the first 81% magnetite and 19% hematite and the second 85%

Table I—Mineral Production of Turkey 1945-1954

(in metric tons)

	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954
Iron ore	125,708	112,210	149,420	191,659	210,948	233,591	222,810	383,947	497,079	586,205
Chrome ore	148,069	103,059	156,603	285,725	451,566	422,529	602,220	805,468	912,523	561,549
Asbestos	138	55	243	303	250	245	80	...	...	45
Antimony	86	159	273	1,316	1,156	3,220	5,414	2,320	1,725	1,783
Copper	9,858	10,050	10,080	10,974	11,283	11,700	17,526	23,330	23,497	24,532
Boracite	5,034	2,210	3,608	5,314	7,082	9,764	12,015	13,730	6,436	14,33.
Mercury	158	...	98	27	...	...	...	...	...	9
Fluorite	...	115	...	...	500	...	...	251	100	...
Sulphur	4,154	3,018	2,662	2,597	3,095	6,006	7,390	8,381	9,778	9,995
Meerschaum (cases)	817	625	208	387	236	265	330	482	537	776
Manganese	5,095	2,370	5,833	8,327	22,576	32,178	50,517	80,508	89,846	49,827
Magnesite	743	100	890	3,621	6,370	450	505	891	350	1,065
Emery	2,106	3,451	11,861	7,861	8,852	2,209	7,369	8,239	1,135	4,802

hematite and 15% magnetite. Geologists believe the deposit is the result of pneumatolitic phase, under which syenite monozonite emanations may have reacted with ankerite and white limestone.

During 1952, Divrik produced 362,447 tons with an f.o.b. value on 205,371 tons-lot amounting to 2,640,825 lira (1 Turkish lira equals 36c U. S.). Output at the Divrik mine in 1952 and 1953 per man-day approximated 2,550 lb.

Iron ore reserves in the Endremit district are reported at 8- to 10-million tons. But the larger portion of the ore contains a high percentage of arsenic. Deposits at Camdag (Adapazari) run about 32% Fe in some 5-million tons reserve. See Table II.

Chrome ore: Major portion of total Turkish chrome ore production and export comes from the private operators (56 concessions and 109 research licenses were owned in 1952).

Exports, as registered by the Committee of Turkish Chromite Producers, exclusive of the government-operated mines at Guleman and Sori, were as follows (metric tons):

1948	100,000
1949	146,627
1950	200,000
1951	330,000
1952	462,532
1953	492,777
1954	271,971
1955	300,000 (est.)

Guleman chromite mines are said to have 700,000 tons of reserve in high and low grade. The high grade is being rapidly depleted. (Table III.)

In the first six months of 1953, the properties produced 63,597 tons and exported 77,529 as follows:

To the U. S., 64,423 tons; Germany, 2,946; Austria, 4,064; Sweden, 3,048; Norway, 3,048. Miner efficiency was about 4800 lb per man-day. (Table IV.)

For a discussion of the geology of Turkey's chrome deposits, see *E&MJ*. April 1954, p 92.

National chrome reserves have been increased during the past few years in zones formerly considered barren. While reserves are not known, pending surveys now under way, a rough estimate may be made. See Table V.

Lead, Silver and Zinc. Lead occurrences in Turkey usually are found with zinc, silver and gold. About 150 such deposits are known, with economic value yet to be established. Balya lead mines, exploited since the time of Pericles, is now idle but said to still contain some values. Keban

Table II—Iron Ore Production (35-65% Fe)

(one Turkish lira equals 36c U. S.)

	Production (metric tons)	Sales (tons)	F.o.b. val. (lira)	Wages and salaries	Other costs (lira)
1945	125,708	101,567	1,218,802	835,779	463,619
1946	112,210	121,548	1,462,086	496,327	298,898
1947	149,420	140,204	1,684,730	659,034	106,087
1948	191,659	161,819	2,257,498	741,889	229,498
1949	210,948	221,255	3,035,183	794,853	323,743
1950	233,591	191,833	2,481,942	794,853	323,74
1951	225,810	223,818	3,036,842	1,057,984	215,91
1952	383,947	318,684	4,858,724	1,575,773	2,754,34
1953	497,079	471,055	7,991,790		
1954	586,205	477,499			

Table IV—Chrome Ore Production (40-54% Cr_2O_3)

	Production (metric tons)	Export sales (tons)	F.o.b. val. (lira)	Wages and salaries	Other costs (lira)
1945	148,069	78,303	3,889,776	1,266,518	2,574,786
1946	103,059	49,120	3,123,094	752,922	1,993,744
1937	156,603	182,157	9,951,010	1,309,395	3,401,119
1948	285,725	285,505	17,229,894	1,287,571	4,071,129
1949	451,566	334,520	23,135,845	2,698,981	7,272,037
1950	422,529	346,536	25,356,955	2,698,981	7,272,037
1951	602,220	491,848	35,654,392	4,541,243	13,145,727
1952	805,468	585,217	46,262,201	6,085,218	10,778,481
1953	912,523	630,230	53,462,324	...	...
1954	561,549	357,178	...	...	...

Table III—Production and Exports of Guleman and Sori Mines

(in metric tons)

	Lump Ore					
	Guleman	Sori	Total	Conc.	Low grade	Exports
1945	69,869	...	69,869	...	13,268	40,141
1946	51,299	...	51,299	...	14,555	11,901
1947	51,717	...	51,717	...	223	78,129
1948	99,034	...	99,034	...	26,669	135,931
1949	128,631	44,058	172,689	...	24,693	152,226
1950	115,982	42,345	158,327	7,641	23,526	143,772
1951	101,232	32,003	133,235	26,388	5,790	155,865
1952	...	...	...	...	...	148,837
1953	...	...	...	...	...	139,789
1954	...	...	...	...	...	71,869

Table V—Estimated Chrome Reserves of Turkey

(in metric tons)

District	Est. reserve	Remarks
Orhaneli, Bursa	100,000	High and low grade, 50–50
Kelkit River valley (N. Erzincan)	500,000	Difficult geographical conditions
Eskisehir	400,000	Low grade and some refractory
Kayseri	50,000	Mostly high grade
Bozanti-Karsanti-Iskenderun	500,000	Difficult conditions
Eastern Turkey	400,000	Difficult conditions
Ockopru-Karayin, Karaismailler	400,000	Mostly high grade
	2,350,000	

mine (Elazig) is now producing 40 tpd from a salvage operation. The Derebaca mine carries lead, silver and zinc, with some copper. Grades reported are: silver, 400 grams per ton; lead, 12%, and zinc, 15%. Up to 1833, these mines produced some 4,500 kilograms silver annually.

Gumushane mine contains silver-bearing lead deposits, about 2,550 grams silver per ton. Important deposits of lead have been worked at Ardahan, eastern Turkey, where ore ran a reported 78%. Other silver occurrences include: Balya, 1,800 grams silver per ton; Akdag, 1,338; Avcular, 600; Keban, 400; Denek, 454; Bolkardag, 250. Principal zinc occurrences are at Mentesdere, Karasu, Bazar, all with economic values as yet unproven.

Manganese and Antimony. Recent discoveries of sedimentary manganese deposits in Denizli and Eregli on the Black Sea coast are promising. Small deposits of volcanic origin are scattered throughout northern Turkey and some workable deposits have been reported near Ankara and in European Turkey. Manganese occurrences in eastern Anatolia contain high silica.

Some 30 antimony deposits are known, but most are far from transportation. In Demirkapi and Ivrindi, the average grade is said to be 63%. Principal known deposits are the hydrothermal Turhal mine and the Goynuk mine, a contact deposit.

Antimony is known in sizeable amounts in Turhal County. In years 1949 to 1952, mines in area yielded 12,000 tons ore and sold 3,962 tons concentrate. Reserves of the three mines aggregate to 90,000 tons 13% Sb.

Meerschaum. The Eskehir deposits produce nearly all the commercial meerschaum used in the world. The mineral is scattered in the drift material on the plain of Tastepe, consolidated by lime in nodules varying in size from that of an egg to that of a football. Mining, dating back some 2,000 years, remains very primitive.

Boracite. Bandirma, on the Marmara Seas is a source of boracite, where an English firm operates the property.

Mercury. Principal occurrences are Halikoy, Baltali, Golbasi and Karaburun, all in western Turkey. The last-named deposits occur in calcite.

Three deposits known in Izmir with one at Denizgeren assaying 8.44% Hg. Deposit near Manastir is estimated to contain 23,000 tons 2.05% Hg. One at Kutahya probably contains 140,000 tons. Near Baltah a 50,000 ton deposit assaying 1.67% mercury is known.

Molybdenum is encountered mainly in three districts: the southern slopes of Uludag, near Bursa, where molybdenite appears in granite; at Dikmendag, near the Dardenelles, and at Keskin.

At Bursa moly occurs in quartz veins over a length of 600 meters and width of 300 m. Grade is 0.6% Mo.

Sulphur in the district of Keciburlu, the most important Turkish source appears in beds with a thickness ranging from 2 to 20 meters, with values 20 to 40% S. Property is government-managed.

Tungsten, in the form of scheelite, is proven in two separate orebodies on Uludag, near Bursa. Both orebodies contain shafts, drifts and have been the scene of diamond drilling. Reserves are calculated at 1,310,000 tons of 0.30% WO_3 content on the upper body and 3,190,000 tons with an average content of 0.575% WO_3 in the lower.

Copper is found in the following provinces, according to C. W. Ryan in his pamphlet, *A Guide to the Known Minerals of Turkey*,: (Western Anatolia) at Istanbul, Kocaeli, Cannkkale, Balikesir, Bilecik and Denzili; (Central Anatolia-Kastamonu) at Corum, Ankara, Konya, Antalya and Icel; (Eastern Anatolia-Ordu) at Giresun, Coruh, Gumushane, Kars, Sivas, Erzincan, Tunceli, Erzurum, Malatya, Elazig, Diyarbakir, Siirt, Hatay and Bitlis.

In the area along the Harsit River, there are reported to be more than 50 occurrences of copper in deposits not as yet explored. Scattered over the territory mentioned above are numerous small deposits in addition to the major ones discussed below.

According to Adnan Halet Taspinar, consulting engineer, the largest producer is Ergani at Elasiz. Deposit is known to contain 2.5-million tons 9.5% copper in pyrite and an additional million tons of 4 to 5% copper that will be floated in the mill designed and built by Western Knapp.

Ergani was covered in *E&MJ* April 1950. It is a state-owned mine that has produced well over 100,000 tons blister since its inception in 1939. Present capacity is about 16,000 tons blister per year. Blister runs 8.32 oz silver and 0.7 oz gold per metric ton.

Orebody, according to S. E. Birgi, is roughly elliptical in shape through the massive pyrite section. Its long axis is about 1,150 ft with a NW-SE direction. Short axis is 530 ft. Orebody is encased between serpentine on the south and chlorite or diabase on the north. Ore is disseminated in schistose rock of Tertiary age and the zones are separated by numillitic limestone. Under the pyrite mass the ore is streaky and consists of pyrite, chalcopyrite and other sulphides.

Ore runs about 8.2% magnetite in lower levels and is mixed with the high pyrite ore for smelting. About 9% of the copper is in readily soluble sulphate form and is constantly being leached out of the ore by mine water. About 700 tons of cement copper are recovered from mine water each year.

Mine is operated as open pit and hand mining is used to keep up grade.

Power for the mine comes from two steam turbo-generators drawing water from the Tigris River. An excellent machine shop is maintained as a necessity, due to the lack of adequate machine parts sources. About 1700 men are employed at the property which has its own schools and hospital.

Coruh is the next largest copper producer. It is located near Russian border in Artivin and has an estimated 15-million ton orebody running 2.05% copper, 7-9% iron and 0.08% cobalt. Exploration began in 1951 and about 8,345 tons blister were shipped in 1952. Mine is state-owned and has 1200 tpd milling facilities. Smelter returns show 0.39 oz gold and 28.29 oz silver per ton blister.

Fifty miles from Murgul there is an undeveloped deposit believed to contain 15-million tons 6.8% copper ore. Orebody is relatively tabular and about 15 meters thick.

Near Take township and village there are scattered deposits containing a million tons of 2.5% copper ore.

A new company has been formed by Sumer and Etibank to exploit the private orebody at Asikoy for its copper. Company has 1,250,000 (lira) capital.

According to Ryan, much of Turkey is rugged terrain that makes transportation difficult. All railroads are single line and with few exceptions on heavy grade and slow schedules. Wet weather and heavy trucks play havoc with village roads. Snow completely blocks some mountain roads in winter. The National Highway Board is advocating considerable road improvement, since there is less than 5,000 miles of hardtop road in the country.

Other minerals, such as emery, magnesite, asbestos, vermiculite, perlite, bauxite and rare minerals are known in Turkey, but information on production procedures is scarce.

"FLEUR DE LIS" dredges some 30,000 cu yd per day from bottom of Black Lake. Waste is piped to disposal area. Note dump pile at top left. Dredge uses a 32-in. centrifugal pump to move material through pipeline, powered by 6,000 hp motor.

Canada Moves a Lake to Mine Asbestos

MORE THAN 25-million yards of mud, sand, gravel and boulder clay are being removed from Black Lake, Que., by Lake Asbestos of Quebec, Ltd., subsidiary of American Smelting & Refining Co., in preparation for open pit mining a large orebody buried 70 to 200 ft below the water surface.

Target 1958

Project is being operated on a profit-sharing basis by AS&R with United Asbestos Corp., Ltd., of Toronto. Proposed initial milling rate when the property begins production sometime in 1958 is 4 to 5,000 tpd.

Removal of the lake waters involves construction of four dams, two dikes, a diversion channel, two large disposal areas and dredging of the Becancour River to greater depths. (See map, following page.)

Black Lake, about 2 miles long by one-half mile wide, was almost overlooked in the search for asbestos in Quebec's ore-rich Eastern Townships, begun when the first mineral finds were made in 1877. The sub-surface orebody was discovered in 1948 and explored four years later by AS&R, which decided to plan for open-pit mining after some 75,000 ft of diamond drilling and 5,000 ft of underground work proved the size of the deposit.

Construction at the site began in May 1954. First step was to channel a strip across the north end of the lake for a diversion channel to carry the waters of the Becancour from their point of entry to the lake beyond (and outside) its natural shoreline. Channel (see map) is 7,000 ft long by 100 ft wide and was completed in early 1955.

As the channel construction began, contracts were also let for the construction of the dredge "Fleur de Lis" and its steel pipeline to carry waste to the disposal areas.

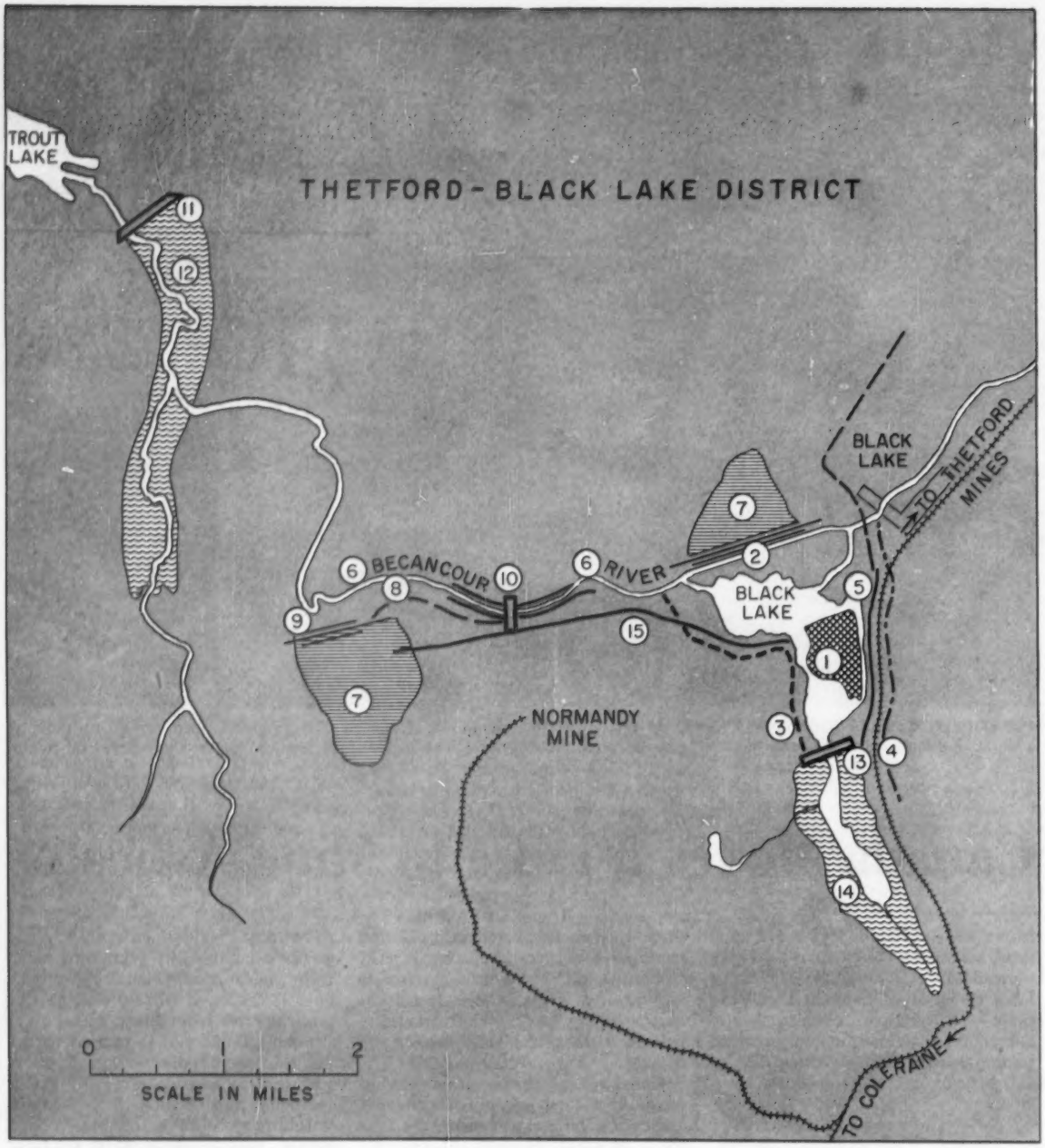
The electric powered dredge is 140 ft by 40 ft, weighs some 200 tons. Hull is fitted with a 32-in. centrifugal pump powered by a 6,000 hp electric motor. The 75-ft cutter ladder is powered by an 800 hp motor.

Capacity of the dredge is some 35,000 gpm; average daily output approximates 30,000 cu yd. Electric power is supplied by submarine cable from Shawinigan Water & Power Co. lines at Thetford Mines, a short distance upriver from Black Lake.

Dredged material is carried across the lake by a pontoon line 3300 ft long and to disposal area "C" by a shoreline pipe 20,000 ft in length. Waste pipe is 32 in. dia and, once ashore, runs beside a 20 ft roadway which connects the Black Lake dredging area with disposal area C. Road had to be built to accommodate 25-ton-capacity cranes which service the line. Outlets along the shoreline have been placed at 14,000, 18,000 and 20,000 ft.

Two Boosters

Two booster pumps are located on the shoreline pipe, the first equipped with a 6,000 hp motor and the second with a 3,000. Dredge spoil will move through the pipe at 17 fps. Electric-welded steel pipe for the pontoon and shore pipelines was built by Alco Products, Inc., and Montreal Locomo-



How a Canadian mining company plans to mine a lake bottom

1. Area on east shore of Black Lake to be excavated in preparation for open pit mining by Lake Asbestos of Quebec, Ltd.
2. Becancour River diversion channel across north side of the lake.
3. Interception ditch running from west side of reservoir dam to Becancour River.
4. Interception ditch (east side).
5. Relocation of 1½ miles of highway back from shoreline.
6. Widening and deepening of Becancour.
7. Disposal areas "A" and "C"
8. Water return ditch to carry water from disposal area back to river.
9. Disposal area "C" dam.
10. Water return dam to control flow down the Becancour.
11. Trout Lake dam.
12. Area affected by Trout Lake dam.
13. Black Lake dam.
14. Area affected by Black Lake dam.
15. Dredge pipeline.

PONTOONS support 3500 ft of 32-in cast pipe as it crosses Black Lake.

WASTE gushes from 30-in. discharge pipe at disposal area. Material travels some three miles from dredge at 17 fps. Two shore-based boosters help move it along.

tive Works, Ltd., Alco's Canadian affiliate. Pipe was built on contract for Construction Aggregates Corp. of Chicago, agents for Lake Asbestos in construction and operation of the dredging operations. It included 25,000 ft of shoreline pipe, 32-in. O.D. with ½-in. wall thickness and 3500 ft of pontoon pipe, 32-in. O.D., with ¾-in. plate. Pipe was installed in 50-ft lengths.

Twelve Months a Year

Dredging will be year-'round, with an ice-breaker working during the sub-zero winter months. As dredging proceeds, water in the lake will be lowered—as much as 80 ft in the first year and possibly more rapidly after that. Water for dredging will be supplied from a reservoir constructed at the south arm of Black Lake and by means of a water control structure at the Becancour River diversion channel at the north end of the lake.

Reservoir dam at the south arm of the lake is earth fill (150,000 cu yd of earth, gra'el and rock). Rip rap was placed on the south, or upstream side.

At the other end of the disposal pipeline, 3 miles west of the lake, Lake Asbestos has constructed a 4700-ft long dam, 72 ft at its highest point, with an approximate 200-ft wide top and a maximum width at base of 1000 ft. Area behind the dam will hold some 25-million cu yd of material. Water from the waste area is carried out to a "water return" dam on the Becancour which admits it to the stream at a rate which will not disturb the current bed.

Becancour River channel was improved north and south of the water return dam, located between the disposal area and the lake. A 2-mile length where the diversion channel enters was widened and deepened to handle rapid run-off during flood periods. Some 30,000 cu yd of material was removed.

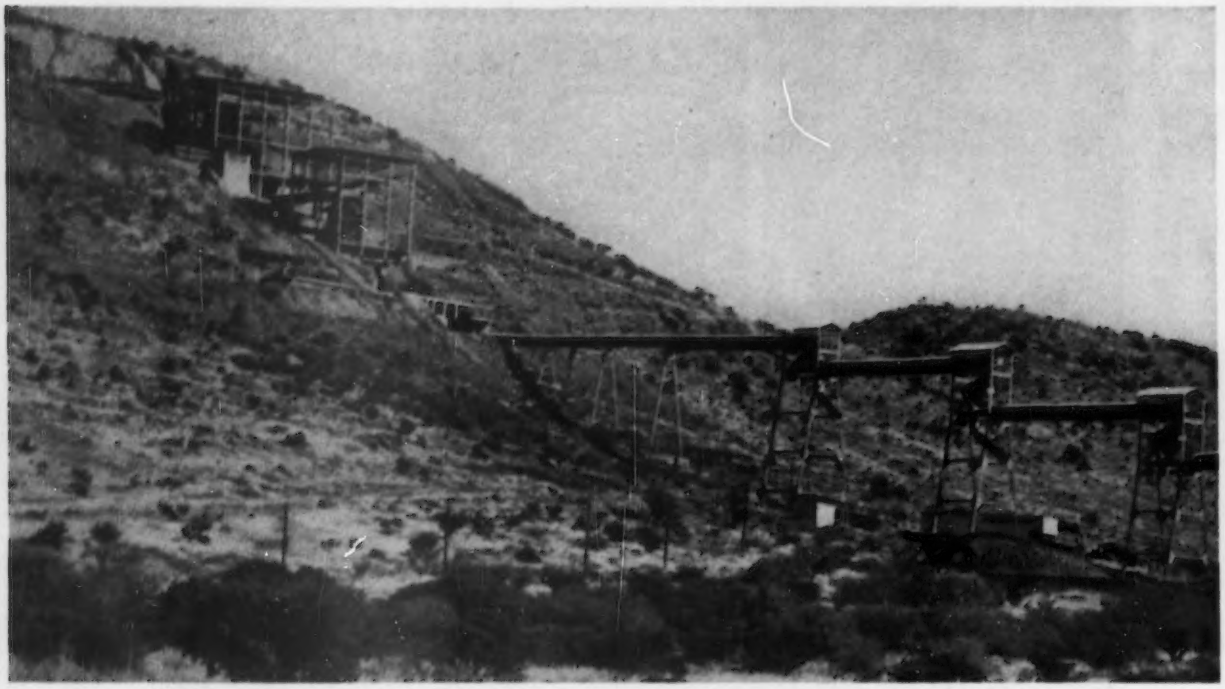
LULL in discharge operation shows pontoon-mounted pipe. Three separate discharges are located along the route, at 14,000, 18,000 and 20,000 ft from starting point.

For further protection against flood seasons, interceptor ditches have been constructed on both sides of Black Lake running north from the reservoir dam to the Becancour and dikes have been built along the north side of the lake south of the diversion channel.

East of the dredging operations some 1½-miles of highway had to be relocated. New stretch runs between the east interception ditch and the shoreline of the lake. A railroad line running alongside the highway does not have to be moved, according to plans of the company's engineers.

Final dam under construction is at Trout Lake, northwest of the principal clearing operations. There, a dam will restrain water from the Becancour and Pine rivers, permitting a flow somewhat as it was before Lake Asbestos began operations. Area affected by the Trout Lake dam (see map) extends south beyond the junction of the rivers but is distant from the disposal area and other parts of the project.

Staff residences and a maintenance shop have been built at the site and plans for other construction are going ahead. After all dredging is completed, it is estimated that some 5-million cu yd of overburden must be removed before regular open pit mining can begin.



CERRO DE MERCADO'S modernized ore handling system is a series of belt conveyors from crushing plants (left) to

Million Dollar Program Modernizes

J. H. KEARNEY
McGraw-Hill World News
Mexico City, Mexico

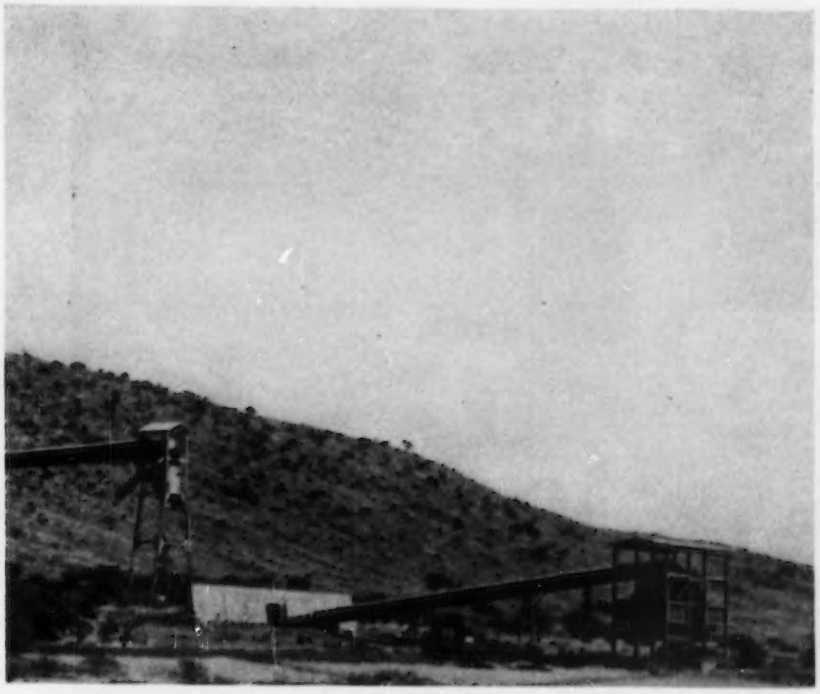
OPERATIONS AT CERRO DE MERCADO, Mexico's mountain of iron ore, rising some 500 ft above the city of Durango less than a mile away, have just undergone a $1-million mechanization program which makes it one of the most modern mines in Mexico, capable of producing 10,000 tons of ore a day.

Assays of Cerro de Mercado ore read at 62% Fe, 3% SiO_2, 0.6% phosphorus and a negligible trace of sulphur. Unofficial estimates based on surface exploration, place reserves at about 100-million tons of high grade hematite. Ore occurs as a huge capping on the rhyolite core of the mountain. No underground exploration has been carried out as yet.

Mining has been going on at Cerro de Mercado for nearly 400 years but until very recently mining methods were primitive. In November 1955,

CRUSHING PLANTS and screens, fed by trucks from mine, produce the six sizes of product from 2-in .to minus ¼-in.

PUSHBUTTON CONTROL permits one man in cabin under primary crusher to handle distribution of various size products.



stockpiles at each tower, through reclaiming tunnel beneath towers to loading bins.

Mexican Iron Mine

however, a modern system was placed into operation which spanned a hundred years of mining technology.

Primary and secondary crushers located high on the mountain slope, a belt conveyor system and an automatic loading device, all under push-button control are included in the modernization program. All except the loading mechanism are controlled by one man from a cabin just under the primary crusher. The loading mechanism is controlled by another man from a weighing cabin under the loading bins. There are also "stop" and "start" buttons along the system.

Allis-Chalmers provided the cast steel crushers and the screens, all of the Ripl-Flo vibrating type. Joy Mfg. Co. supplied the mechanical equipment of the conveyor system. The belt itself was furnished by the Goodrich Euzkadi Co., Mexican affiliate of the B. F. Goodrich Co. of Akron.

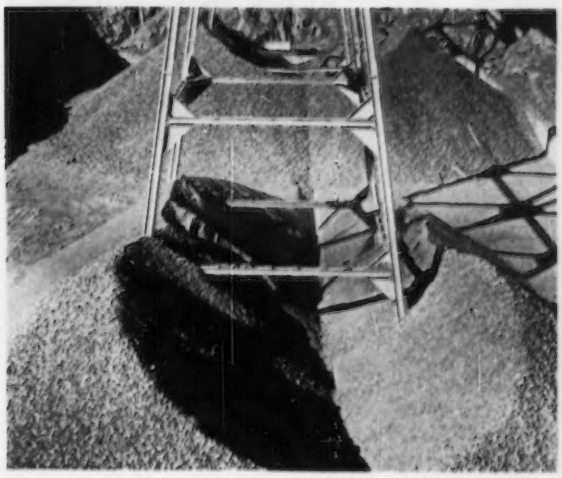
Present open pit workings are at the 330-ft and 390-ft levels. Mining is carried out in benches uniformly 60 ft. high but of varying widths. Two Bucyrus Erie 9-in. churn drills put down 67-ft holes, 18 ft from the ledge about 18 ft apart.

From 15 to 20 holes are blasted at a time. For blasting, the holes are tamped with 40% and 60% granulated dynamite, supplied by Compañia Mexicana de Explosivos, S.A., of Dinamita, an affiliate of Dupont. The dynamite is detonated with primacord. This results in a blasting yield of 50,000 to 60,000 tons. Secondary fragmentation often is necessary. Crews drill holes with Ingersoll Rand Jackhamers and break boulders with 40% dynamite in cartridges.

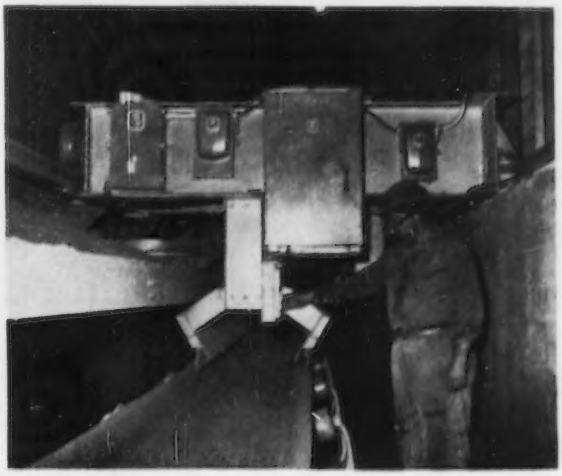
After blasting, two D-8 Caterpillar bulldozers gather the rock for two Manitowoc 2½ yd diesel shovels, which load four 22-ton Euclid end-dump trucks. To reduce abrasion, both the teeth and the bottoms of the shovels' dippers are manganese.

The Eucs haul a 25-ton load to the top of the conveyor installation high on the mountain slope dumping onto a 6-in. manganese grizzly set at the 300-ft level. Undersize falls through to a chute into a heavy-duty 42-in. Link Belt apron feeder set at the 255-ft level. Oversize tumbles to the primary crusher, a gyratory with a 42-in. opening and a 65-in. bell, set at the 270-ft level. Here the ore is reduced to minus 6-in.

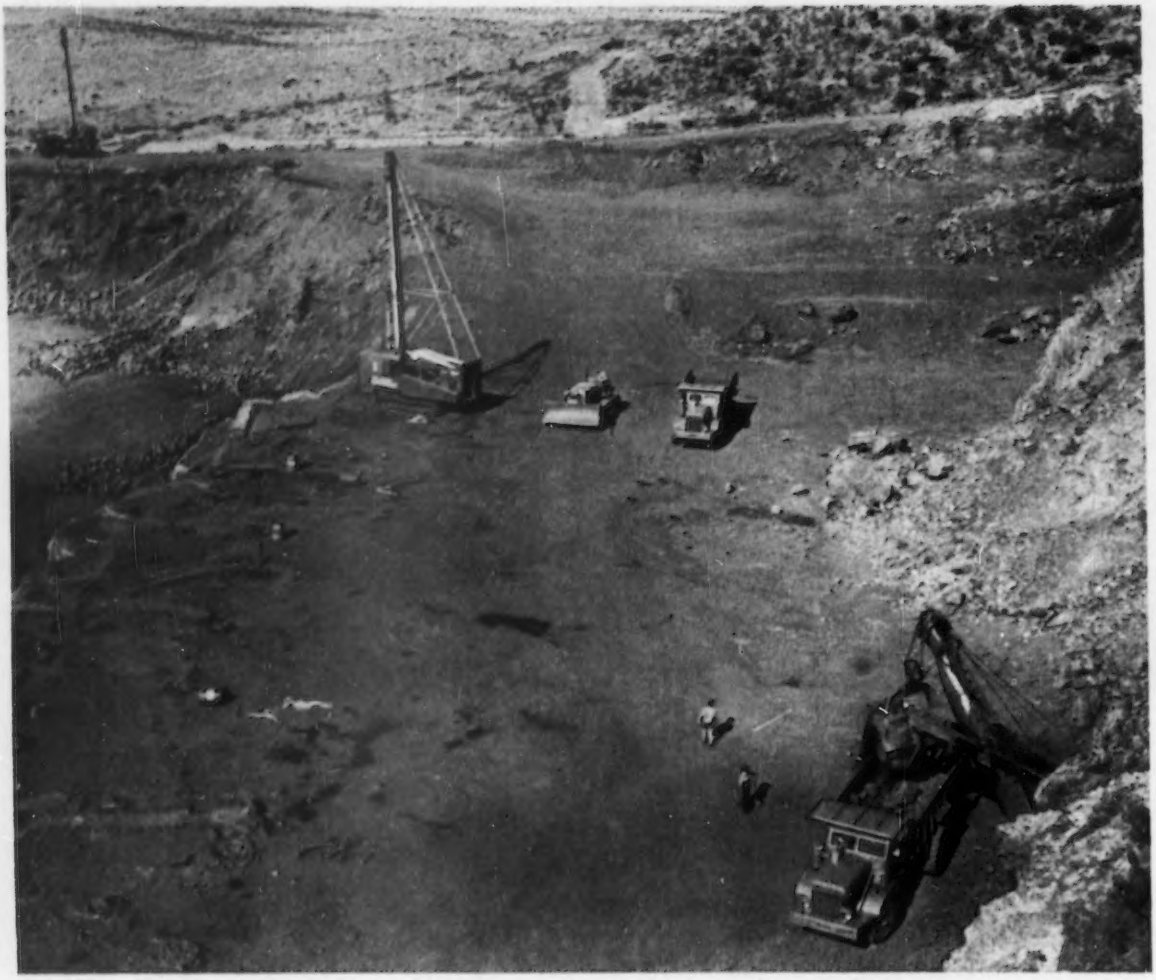
This minus 6-in. empties onto the apron feeder which already has caught



STOCKPILES are reclaimed through slot to loading shelf in 450-ft long, 9-ft wide tunnel passing beneath all stockpiles.



ROTARY PLOW FEEDER, a self propelled unit, cleans ore off loading shelf onto belt conveyor going to the loading bins.



MINING is carried out in 60-ft benches. After blasting, two bulldozers gather rock for the two 2½-yd diesel shovels. The shovels load four 22-ton Euclid trucks for haulage to the crushing plant. Production is about 80,000 tons per month.

LOADING BINS both have four compartments and loading of any size can be controlled by man from cabin below bins.

LOADING CONTROLS permit one man by pushbutton to load any tonnage from any pile. Isaac Rubio checks loading.

the grizzly undersize. From this apron feeder, the rock is conveyed 100 ft. to a double-deck (4-in. and 2-in. mesh) suspended-type heavy duty 6x12-ft vibrating screen. The 4 to 6-in. ore may be chuted to a reinforced concrete hopper to hold this open-hearth furnace size in reserve. Or, this rock, along with the minus 4-in. and the plus 2-in. may go to the secondary crusher. The minus 2-in. is chuted to a second 42-in. Link belt apron feeder, set at the 210-ft level, below the secondary crusher.

Six Sizes Sorted

The secondary crusher, a Hydro-Cone with a 12-in. opening and a 60-in. bell, is set at the 225-ft level. Here ore is reduced to minus 2-in. This then falls to the second apron feeder, which already has caught the minus 2-in. from the double deck screen. All this minus 2-in. material is conveyed by a belt 410 ft long (all belts are 30 in. wide) to Tower No. 1, from whence it is chuted to a run-of-mine stockpile.

As needed, the trap door on the concrete hopper containing open hearth size ore may be opened and using the same apron feeder and same belt, the ore is conveyed to an open-hearth stockpile, also beneath Tower No. 1. When run-of-mine (1- to 2-in.) is not wanted, the chute is closed and this material is conveyed 131 ft to Tower No. 2, where there is a 6x16 ft single-deck screen. Plus 1-in. falls to its stockpile.

All minus 1-in. is carried on a 125-ft belt to Tower No. 3, to another single-deck 6x16 ft screen, of ¼-in. mesh. Oversize falls to a fourth stockpile. Undersize is conveyed 118 ft to Tower No. 4 to a final single deck 6x16 ft screen from which the material is discharged into a plus ⅛-in. stockpile and a sixth, and final, stockpile for fines (Cerro de Mercado plans to begin construction in 1956 of a sintering plant for these fines). Total stockpile capacity is more than 70,000 tons.

Underneath all stockpiles runs a tunnel, 450 ft long and 9 ft wide. Within this tunnel there operates a Link Belt rail-mounted self-propelled rotary plow feeder. Also, inside the tunnel is a 656-ft belt which after leaving the tunnel begins a 12 deg ascent to two 4-compartmented loading bins, set at a height of 45 ft. To support the tremendous weight of the stockpiles, the roof of this tunnel is reinforced concrete 24-in. thick supported by 15-in. steel beams every 3 ft.

There is a shelf opening beneath all stockpiles. This shelf is at the same height of the six-armed rotary plow feeder. As the material is plowed off the shelf onto the belt, additional material gravitates from the stockpile above to replenish the shelf. In the tunnel, along the shelf, the six stockpiles are numbered.

CARLOS F. MALDONADO planned almost every detail at Cerro De Mercado.

Loading bins are high enough so that railroad gondolas and hoppers can pass directly beneath. When the weighing room operator wants a particular size ore, he presses a button and the rotary plow feeder moves to the section of the shelf beneath that stockpile. The weighing room operator watches a Howe 100-ton automatic scale to know when the requested tonnage has been loaded.

The Spanish Captain

The mountain known today as Cerro de Mercado was discovered by Spanish Captain Gines Vazquez de Mercado in 1552.

Since the landing of Cortez at Veracruz, 36 years earlier, the Spaniards had heard glowing tales from the Indians of a mountain of silver, somewhere to the northwest. It was this legend which brought Captain Vazquez de Mercado to Durango.

The Captain, in his quest for the mountain of silver, passed through many mining areas. He specifically examined silver mines in Zacatecas and Fresnillo. Many of the mines he disdained have since been worked successfully.

Vazquez de Mercado cursed his fortune when he found that the mountain was not of silver but of iron. Nevertheless, he planted a cross in the name of Spain atop the mountain's highest peak and to this day crosses have been maintained on that spot. It was one of the last official acts the Captain ever performed. He was killed by Indians on his return to Guadalajara.

Loading belts move at a rate of 400 fpm. It has been figured out that a piece of rock dropped into the primary crusher would reach the loading bins in 3¼ minutes. The system can move an estimated 675 tons an hour without undue strain.

The system is so flexible that production of greater amounts of any particular size of end product desired can be accomplished by simply opening or closing chutes, again all under push-button control.

Working only a total of 120 men on three shifts, including guards and maintenance men, the system can produce as much as 10,000 tons a day. Right now, however, Cerro de Mercado, working only one production shift, is producing just 80,000 tons a month. Production will be stepped up as market conditions warrant.

Shipped By Rail

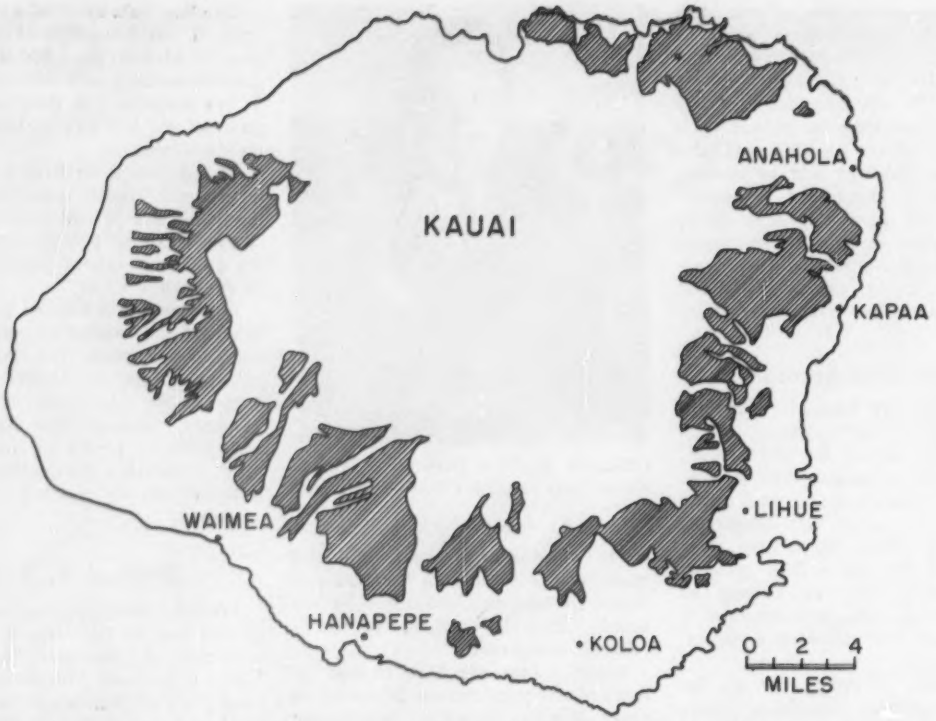
Present monthly shipments are: 28,000 tons to the recently-expanded steel mills of Compañía Fundidora de Fierro y Acero de Monterrey, S.A., at Monterrey (Fundidora is the principal stockholder of Cerro de Mercado, S. A.); 28,000 tons to Altos Hornos steel mills at Monclova, Mexico; 15,000 tons to the Sheffield Steel Corp. at Houston, Texas, and the remainder to small Mexican and Texas users. The loading bins are only a mile from the national Mexican railway, and shipments can be made by rail to any part of North America.

The entire system is the brainchild of Carlos F. Maldonado, general manager of Cerro de Mercado. Maldonado originated the idea and planned almost every detail. In addition, he has supervised every development since the actual start of construction in March 1954. Maldonado, 47, father of 7 children, is a Certified Public Accountant whose dream of this installation, and the realization of that dream, has made of him a competent mine superintendent.

His chief lieutenants have been Ing. Salvador Villamar, who is chief of Fundidora's Mining Department and who served as consulting engineer for Cerro de Mercado; Ing. Isaac Rubio, mine manager of Cerro de Mercado, and Ing. Ignacio Carrillo, who worked out all details of construction which included more than 1,000 tons of structural steel.

Acknowledgement

E&MJ is indebted to the entire staff at Cerro De Marcado for the many courtesies extended during our recent visit to the property, located only one mile out of Durango.



KAUAI ISLAND has largest deposits of the six titanium-bearing islands. Shaded areas indicate ore-bodies, which run from one to six feet below surface, and could be mined by stripping methods.

Vast Titanium Deposits Seen in Hawaii

On the gentle slope of the six "older" Hawaiian Islands, large amounts of rich titanium have been deposited. Climatic action has helped separate the ores and "ground" them to a 300-mesh size.

AUTHOR AUSTIN, retired general manager, Mancha Div., Goodman Mfg. Co.

C. C. AUSTIN
Menlo Park, Calif.

TWO DISTINCT TYPES of titanium-rich deposits have been established in the Hawaiian Islands, according to Dr. G. Donald Sherman, of the Hawaii Agricultural Experiment Station of the University of Hawaii.

The deposits are very shallow and present a number of difficulties, both in processing and in mining, the latter because land areas in the islands are in great demand either as reservoirs of valuable rainfall or as acreage for the vast sugar cane and pineapple plantations.

Discussing tonnage reserves Dr. Sherman says, "I can only give a rough estimate . . . .

EXPERT SHERMAN has studied and written on soil structures in Hawaii.

"The island of Kauai has about 20% of its area covered with titanium-rich soil. The area of Kauai is 551 square miles, which means that there are some 100 square miles of soils containing more than 8% TiO_2. If we assume this entire area to be one foot in thickness, it would contain some 300-million tons of titanium ore. But the average depth of the deposit is between 3 and 4 ft, so that the actual tonnage is extremely high.

"The titanium deposits of the Islands are of two types. One is the ferruginous laterite containing 10 to 35% TiO_2 and the other is anatase-halloysite type containing 8 to 25% TiO_2."

The titaniferous-ferruginous laterite soils are contained in the relatively shallow surface formations which range from 1 ft to 6 ft. As it nears the surface, it is much richer in titanium oxide. The second type occurs in locations where internal drainage is sufficiently sluggish for poor aeration to develop . . . . the poor aeration causes the differential reduction of iron oxide and its removal to an area where conditions for its oxidation are more favorable.

Mineral Composition of Typical Titaniferous-Ferruginous Laterite Crust Profile

(in percent)

Depth in ft	Quartz	Kaolin	Gibbsite	Hematite	Goethite	Anatase *	Accessory minerals
0–3	5	5	..	50	10	20	ilmenite 2.0 chromite 1.0 maghemite
3–18 crust	3	0	0	55	..	30	maghemite 2-5 chromite 1.0 ilmenite 2.0
18–30	2	0	10	30	30	10	ilmenite chromite
30–36	5	5	20	20	45	5	chromite
35**	5	60	15	15**	..	..	.....

*Identification of anatase is tentative. Mineralogists have made conflicting identification of samples from laterite crusts. Several insist on the ilmenite identification while others feel that TiO_2 exists as an independent oxide (anatase) based on a 4.3 A line on X-ray diffraction patterns.
**Magnetite.
From: "Some of the Mineral Resources of the Hawaiian Islands," by G. Donald Sherman.

Titaniferous-Ferruginous

The first type is always found on slopes where the existing climate has definite, alternating wet and dry seasons. Such a climate is conducive to rapid chemical weathering under conditions favoring the alternating reduction and oxidation conditions. In general, according to Dr. Sherman, these areas occur just below the wet, tropical forest where weathering conditions favor the solution of iron and titanium through their reduction. Certain conditions are apparently necessary before TiO_2 can accumulate in these deposits. They are, Dr. Sherman says[1], as follows:

(1) Conditions favoring intense chemical weathering under both reducing and oxidizing conditions. (Under such conditions titanium is released from its normally weathering-resistant minerals and will become soluble in the acid, and probably very reducing environment.)

(2) Conditions favoring the movement of titanium in the percolating water to an area of accumulation. (This hypothesis would have the dissolved titanium moving in the near-surface percolating waters, which would carry it to a dryer and more oxidizing environment, where it would be deposited.)

(3) Above condition requires the movement of titanium in percolating waters near the surface; and, in order to have this condition, it is necessary to have an impervious layer near the surface. (Such an impervious layer may be unweathered parent rock, but more commonly it is the point of contact with the subsoil plastic kaolin clay. The layer is formed by deposition of iron oxide, often as a hard concretionary layer.)

(4) A definite dry period is essential to cause the ascending movement of titanium toward the surface, where it is precipitated and dehydrated to the oxide called anatase.

Composition of the titaniferous-ferruginous laterite is determined by the vegetative cover, topography and age. Vegatative cover is the protection in this area against dehydration of the hydrated oxides. When the protective cover is removed, dehydration occurs. Prior to dehydration the titanium oxide content is uniform in deposit above the subsoil layer.

Deposits always occur on slopes, with greatest development on benches or small plateaus. A deposit is likely to be a foot deep on a steep slope, close to 4 ft on gentle inclines and as much as 10 ft on benches.

Influence of age is shown in high contents of iron and TiO_2 and in the complete desilication of the deposit. Appreciable kaolin is found in the youthful deposits of this type.

Land in Use

Amount of ore available and obtainable presents a problem on titanium-rich Kauai, as it does on the other islands. The Kauai ore lies on lands now raising sugar cane and pineapples and beneath forests needed to consume water resources. Opposition to the removal of these ores would probably be intense, from the government for the latter and from the large plantation owners for the former.

Dr. Sherman sees a compromise possible that would provide enough ore for profitable mining for 10 to 15 years with an annual ore output of some 500,000 tons. Mining on the islands would probably have to parallel the practice of replacing topsoil and vegetation as practiced by the Reynolds Metals Co. in Jamaica. (See *E&MJ*, September 1952, p 108.)

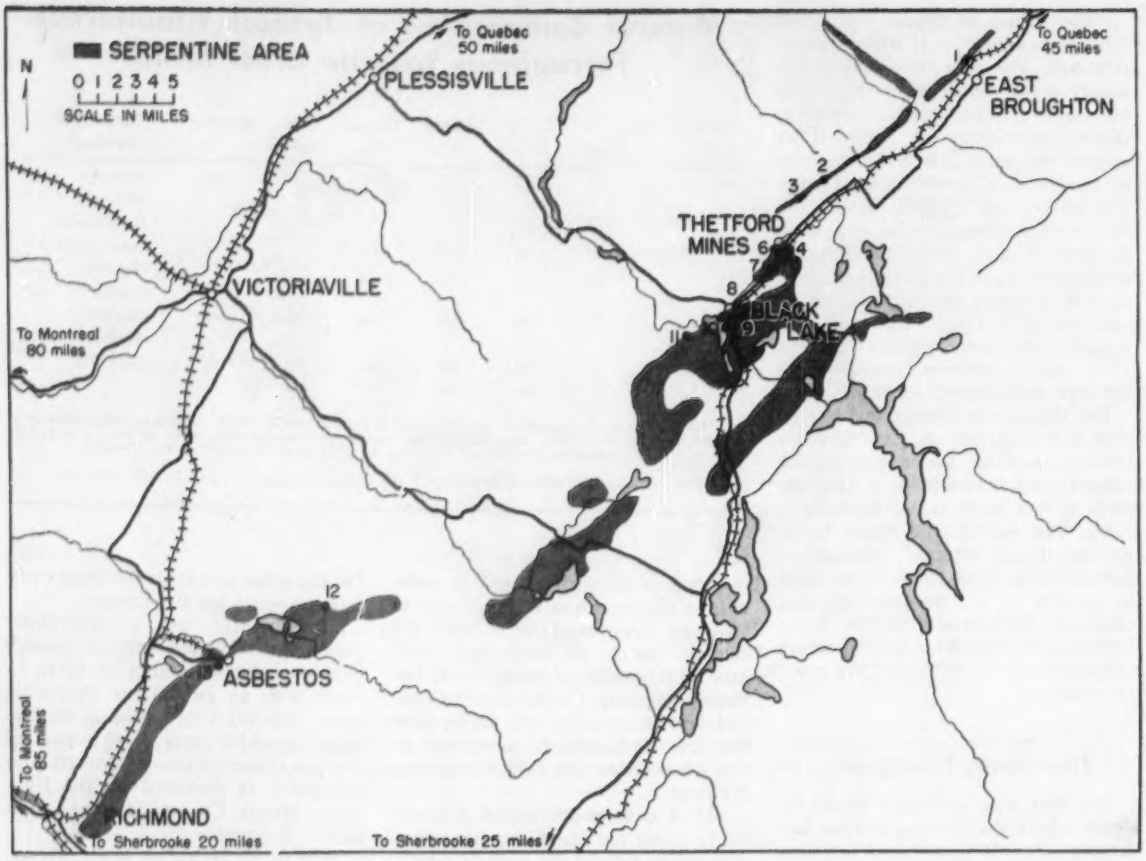
Title to all Hawaiian lands, except about 3,000 acres, is vested in the Territory government and administered by the Commissioner of Public Lands. Negotiations for a mining lease are initiated by applying to the Commissioner, who, after the prescribed period of time, offers it for sale at a price above a set minimum. Title to privately-owned ore can be purchased from the land owner.

While the islands of Lanai, Maui, Molokai, Oahu and Hawaii have deposits, none is larger than Kauai's. Weather is not a problem and presents no obstacles to mining and shipping.

Concentrating is a problem, but not, Dr. Sherman thinks, an insoluble one. The ore has been "ground to about 300-mesh by natural forces and dispersed through a clay gangue contaminated by iron oxides." Sherman's preliminary work shows that the clay gangue can be removed by flotation. The iron is magnetic and probably can be removed by magnetic methods. About 75% of the TiO_2 can be recovered and concentrate should be about 65% TiO_2.

The ferruginous laterites have a very high iron content, but due to their high TiO_2 content they are not suitable for development. Neither are the manganiferous deposits considered interesting, except in the most dire shortage.

[1]"Some of the Mineral Resources of the Hawaiian Islands," by G. Donald Sherman. Special Publication No. 1, Hawaii Agricultural Experiment Station, Univ. of Hawaii, Honolulu, June 1954.



Asbestos Mines Improve Caving Schemes

LLOYD E. ANTONIDES
Assistant Editor

ACTIVE GROWTH is the most striking aspect of the Quebec asbestos region today. New properties are being developed, others have only recently come into production and all companies are trying to boost output in an effort to meet ever soaring demand for the versatile rock fiber. (See map and news review above.) New equipment and schemes are being tested to raise quality and hold down increasing labor costs.

Block caving, the region's real forte, is constantly being sharpened into an even more efficient mining method. Low-cost open pit methods keep the pressure on. Ratio of mining costs between the two is about 5 to 1—block caving about $1.50 per ton, open-pitting about $0.30 per ton. Because of this, all new properties are open pits and older pits will be worked for some time and to maximum depths before going underground.

Cut off schemes and draw control have been de-emphasized. The concept of a definite block being caved as a unit has been just about forgotten. The idea now seems to be to bring single slusher or grizzly drifts into production, more or less keeping the break line constantly advancing as in a coal mine panel system. Drawing schedules are no longer a big problem. Muck is just kept moving fairly evenly.

Drilling with air legs and chisel TC tipped one-piece steel is well established. Now, longer holes from 20 to over 45 ft are being drilled with same machines and coupled steel. At least one mine is using slip-on TC bits. In some mines, rather than use extra long steel to get at hang-ups, miners use as many stringer extensions as are needed. Such practice frequently puts machine well up in drawhole, apparently without costly disasters.

Undercutting is done from subdrifts above the grizzly or slusher drifts. Access to the undercut drift is through the draw raises. General practice is to reduce raise work to a minimum by using vertical fans of holes from the undercut drift to bell out the draws. Blasting sequence is to first open a slot at each draw point, then break to them with successive millisecond delay shots.

Slushing is increasing at the expense of grizzlies and gravity passes. Most favor folding-type blades. While no one questions that slushing raises rate of production and cuts pillar height and development work, at least one official debates the crushing effect—in this case detrimental to long fibers, the most valuable grade. Another mentioned that effective use of slushers is possible only when the whole operation is planned for handling large-size muck, which includes having an underground crusher.

Several features of ground support in the block caving practice stand out. The medium hard rock is cut by an intricate network of veinlets, slips and fractures. This, plus tremendous pressure of caving ore, makes ground support a major factor. Concrete is

Activity in Quebec's Eastern Townships asbestos industry . . .

1. Quebec Asbestos Corp. (subsidiary of Phillip Carey Co., Cincinnati) is presently mining 1,000 tons of ore per day from pit covering several adjoining leases along dike. An associated company, Carey-Canadian Mines Ltd., is opening up new orebody several miles northeast. It was discovered by ground magnetic survey in 1949. Stripping and erecting new 2,000-ton mill is well under way.

2. National Gypsum Co. has completed exploration and development drilling, now plans mining.

3. Flinkote Mines Ltd. (subsidiary of The Flinkote Co., New York) just expanded mining to 2,400 tons of ore, 4,500 tons of barren, daily, from pit on dike. Mill started in 1946 has since been enlarged.

4. King Mine, Asbestos Corp. Ltd., is one of three properties on main deposit at Thetford Mines. Output is 3,200 tons of ore per day—2,700 from underground, 500 from open cut on side of pit—plus 1,200 tons of pit waste. It was first to try block caving on asbestos ore in early thirties. Now first level is finished and work is on two lower levels.

5. Johnson's Mine, Johnson's Co. Ltd., on main Thetford deposit, produces 3,300 to 3,500 tons per day. Operations are on second level, approximately 1,000 ft below surface, and on sublevel 200 ft above. New Crusher station was cut in 1951.

6. Bell Mine, Bell Asbestos Mines Ltd. (subsidiary of Turner-Newall, London) mines 2,000 tons per day underground on main deposit. Shaft was deepened in 1947. Now mining is on level about 700 ft below collar. Steady moderate production of somewhat longer grades is maintained.

7. Beaver Mine, Asbestos Corp. Ltd., is developing new "C" orebody open pit. Older pits, already considerably extended and deepened, will continue to be worked. Daily operations handle 3,000 tons of ore, 3,000 tons of barren rock and 4,000 yd of stripping.

8. Megantic Mine, Johnson's Co. Ltd., has stripped large area to connect older pits and new one along hill side. New mill opened in 1954 takes 4,000 tons of ore per day. An additional 2,000 to 4,000 tons of barren rock is moved.

9. British-Canadian Mine, Asbestos Corp. Ltd., produces 6,000 tons of ore, 7,000 tons of barren rock per day. It is adjacent to Megantic Mine. It pioneered converting asbestos pits to truck haulage in late 1940's.

10. Lake Asbestos of Quebec Ltd. (subsidiary of American Smelting and Refining Co., New York) is developing new open pit orebody under Black Lake under profit sharing agreement with United Asbestos Corp. Ltd., Toronto. Removing 25- to 35-million yd of overburden with immense 32-in. suction dredge. Waste is pumped 4 miles to dammed-up valley. River is diverted. Production target is 4,000 to 5,000 tons of ore per day in 1958.

11. Normandie Mine, Asbestos Corp. Ltd., started producing in February 1955 when adjacent Vimy Pit shut down. Pit, on lower slope of mountain, is moving 3,500 tons of ore, 4,500 tons of barren and 4,500 yd of overburden. Gigantic new mill uses six 17-ft Aerofalls.

12. Nicolet Asbestos Mines Ltd. (subsidiary of Nicolet Industries Inc., New York) mines 2,700 to 3,000 tons per day from 125-ft deep pit along edge of serpentine.

13. Jeffrey Mine, Canadian Johns-Manville Co. Ltd (subsidiary of Johns-Manville, New York) has just about finished last half of huge 14 story mill structure. Machinery is being installed. First half opened in 1954. Underground production, started in 1952, is up to 10,000 to 12,000 tons per day. Second main shaft, now completed, is 1,400-ft deep. Pocket is being cut. Open pit continues to move 5,000 to 6,000 tons per day.

the major support material. It is placed with both piston-pumps and compressed air. One property has a highly mechanized batch plant on surface, sending mixed concrete down service shaft to underground placer. The trend is toward massive concrete, over 18 in. thick without steel.

Semi-circular arch and full elliptical sections are replacing rectangular sections in most cases. Reusable, sectionalized forms are mostly made of aluminum for ease of handling as well as supply. But steel has not been forgotten. One superintendent mentioned that where much tailoring of forms to ground must be done, ease of cutting and welding steel makes it better. Most properties have used fairly long, prefabricated sections—which are hinged and erected with a hydraulic boom on a carriage. But it seems smaller hand placed panels are favored now. Joining end ribs with bolts is eliminated at one mine by a handy clamp they developed. Another forward-looking property uses a Ramset gun and studs to fasten steel plate to sets when concreting haulage drifts. After concrete has set, heads of studs are simply knocked off and plate easily removed.

Rock bolting is playing its part. Not only are haulage ways being so supported but undercut drifts in weak ground are also being kept open with them until drilling is finished. In some places they are being used to hold heavy ground while concrete is placed. Expansion-shell type are most common. At one property wall bolts have been grouted in place. Gunite over the bolts reduces the problem of air or moisture slack even though it tends to loosen from the many slick surfaces.

On an unusual item . . . .

ONE PROBLEM peculiar to asbestos mining is wood—taboo because separating it from the fiber in the mill is impossible and it is a highly undesirable contaminant in the final product. Therefore wedges for blocking are about the only wood used. And they are covered with a rubberized fabric to hold splinters together. Low-cost blasting poles for hangups are made of strips of light gage sheet metal, deep crimped longitudinally for strength. They are easily removed from muck by hand or magnet. Loading-tamping sticks are of plastic pipe or aluminum. Even asbestos cement and soft metal are used for surveyors plugs. And to prevent use of wooden matches, companies supply free flint and fluid for lighters.

Haulage has its share of attention. Block signals, full time dispatchers and radio communication are all being used to some extent at various properties. Poured concrete is starting to replace gravel or crushed limestone for ballast in one mine. At another, the problem of derailed trains knocking out steel sets was solved by concreting between legs at all critical spots.

At the Jeffrey Mine, height of ore caved is about 400 ft. Leading from main shaft, haulage level has two parallel entries separated by 100-ft pillar containing service shafts, rooms for shops, lunchroom and other facilities. Haulage crosscuts turn off at right angles on 200-ft centers. Additional haulage drifts divide orebody into 200x400-ft rectangles. Ventilation crosscuts run lengthwise down centers of rectangles and connect to ventilation shaft which has exhaust fan on surface.

RECTANGULAR section is used for grizzly drift support at Bell Mine. Steel framed chamber is later concreted.

SEMI-CIRCULAR arch on main haulage level at Johnson's Mine is also being used in heavy ground at other properties.

ELLIPTICAL section is being adopted at King Mine for grizzly drifts. Knee-braced rectangle was used before.

Floors of slusher drifts are immediately above roof of haulage crosscuts, i.e. 11 ft above rail. In a given rectangle, scrams run toward center from both 400-ft sides at 50-ft intervals. Those from one side are 102½ ft long. On the other side, centerlines are offset 25 ft, and they are 120 ft long. Ends of both interfinger and are connected down to vent crosscut.

Single drawpoints are alternately on right and left side of slusher drift at 17½-ft intervals. Draw cones go up at 45 deg and join 25 ft above scram bottom.

One highlight here is use of long holes to slash slusher drift to full size from pilot drift. Another is use of a poured concrete ramp below tail sheave to stop muck from piling up.

At the King Mine, an over-all description is somewhat complicated at the present time by a sub-level from 400 to 200 ft high, and by use of both slushers and grizzlies. The sub-level is used only along one side of the orebody in order to prevent caving from interfering with the railroad on surface.

In general the mine has a slightly rhombic plan, 640 ft on a side, divided into smaller rhombs 160 ft on a side. Haulage drifts are 80 ft apart with chutes every 26 ft. From chutes, raises go up at 50 deg to grizzly level 45 ft above rail. Grizzly drifts are parallel to haulage and are spaced every 40 ft. Draw raises are opposite each other every 26 ft and cone out at 45 deg to undercut level 16 ft above.

On the sub-level, where scrapers are used exclusively, scrams are 50 ft apart and newer draw points are alternately on right and left at 15-ft spacing rather than opposite at 30 ft. Undercut level is 23 ft above scram level. Ore is scraped into a pass which connects down to a transfer scram running at right angles, 40 ft below. Ore is moved by second scraper to an ore pass to main haulage 200 ft below.

Point of special interest was the use of Copco flexible drill steel for undercutting. The chisel TC tipped steel has a ½x1-in. rectangular cross section and is used in 3-ft changes to 21 ft. A slightly larger than usual undercut drift is needed—8 ft wide—to allow for bending.

At the Johnson's Mine, present main level is laid out in a rectangular plan. Two 1,000-ft long haulage drifts parallel the property line—one 100 ft away, the other 300 ft. From their midpoints a single main haulage entry leads off at right angles toward the shaft. Blocks are considered as being 200 ft wide by 240 ft long.

At this property, need to prevent caving from extending into adjacent Bell Mine has somewhat complicated an over-all plan. But in general, scrams are planned 100 ft long on 40-ft centers at right angles to haul-

In brief review....

ASBESTOS has an ever widening variety of uses stemming from its relatively inert fibrous quality as well as its fire resistance. The word itself is a general term covering several fibrous minerals but 90% of commercial asbestos is chrysotile ($3\ MgO.2SiO_2.2H_2O$) a variety of serpentine. It is usually yellowish green in place but pure white when fluffed. In the Eastern townships of Quebec, where 70% of the world's supply is mined, it occurs in veinlets rarely more than 3 in. thick, which form irregular mesh-like masses in serpentinized ultrabasic sills and stocks containing later acidic intrusives.

Most crystals form across the veinlets — cross-fiber — but some form parallel to the walls—slip fiber. Essentially, value goes hand-in-hand with length of fiber — from over $1500 per ton for longest (+¾ in.) to under $30 per ton for smallest (—10 mesh)—although other properties such as tensile strength, flexibility and absence of iron are important. Yield of all grades averages 6% of rock mined — from about 3% in open pits to 10% underground.

Orebodies are of all shapes. Some are thick, steeply dipping, bed-like deposits. Others are simply irregular bodies. All are spotty in grade. Exploration is primarily a surface search. Magnetic surveys, air and ground, have limited use. Evaluation is based on visual inspection of drill core and actual milling of bulk samples.

Tonnages mined are huge. Underground, where block caving is used exclusively, the older mines produce from 2,000 to 3,000 tons per day while the newest one hoists over 10,000. Open pits handle up to 13,000 tons per day, not including overburden. Although only about half of pit ore is actually milled, all underground ore hoisted is generally treated. Milling, a complicated and somewhat secretive art, is primarily a repeated dry crushing and screening process with fiber being sucked off with air as soon as loosened.

age drifts. Single draw points go up at 45 deg every 12 ft alternately on right and left sides. Undercut bottom is 24 ft above scram level; scram, 48 ft above haulage.

Height of ore caved is planned at 400 ft but one area roughly 450x250 ft along property line is being caved from a sublevel at 200 ft. Here a central service drift runs lengthwise with two scrams turning off at right angles every 40 ft. In the first portion undercut, 204x172 ft, scrams on one side of service drift are 96 ft long those on other 120 ft. A later section is laid out for 150-ft long scrams on one side. Where the scrams join the central service drift, the scram is widened to accommodate a 50-hp scraper hoist. Overhead steel beams make an easy job of moving scraper hoist from one side to other. Floor at scraper hoist installation is reinforced concrete slab with openings to fanned out ore pass centered on service drift. This same arrangement of one ore pass and one scraper hoist being used for two scrams, is planned as standard practice for main level too.

(Continued on p. 110)

About cooperation . . . .

THE COOPERATIVE ATTITUDE of the men mining asbestos is powerfully shown in the solution to a problem faced by the three companies at Thetford Mines. Not only do all three meet at common boundaries within a huge single orebody but the orebody is in middle of town. In 1952 the three companies—Asbestos Corp., Johnson's Co. and Bell Asbestos — agreed to form a joint company — Relocations Ltd. — which is progressively moving portions of town and other facilities outside future caving area.

They also have a Cooperative Mining Committee which meets periodically to exchange operating plans so that property boundaries are preserved and caving will not interfere with adjacent workings. Mining plans are based on a jointly sponsored study by Ford, Bacon and Davis Inc., consulting engineers of New York, which among other things set limit of free caving at a 50 deg angle. Undercuts are also restricted at all times, whether with cut-off openings or not, by an 80 deg angle from property line at uppermost working level of adjacent mines. Leigh W. Bladon, consulting engineer, is chairman of committee.

New Mills Have Blossomed

MILLS in the asbestos country have grown to immense size in the last few years. Canadian J-M's, above, is the largest. The huge structures still house the same basic equipment to crush, screen and air-separate the fiber. But many of the actual machines are improved. With demand becoming more exacting and quality control playing an ever larger part, electrical and mechanical controls are being adopted on a wide scale. Some of the increase in structure size can be laid to the huge central air-exhaust systems now used both for fiber separation and conveying and for atmospheric dust control in the mill. Crushing machines—such as Aerofall mills, conical drum mills and new types of impact crushers—are being tested and, if successful, adopted. Oil fired driers have replaced coal fired ones in a number of cases. And while new automatic pressure packers are the talk of the mill men, materials handling in general is being studied.

Open Pits Play Big Part

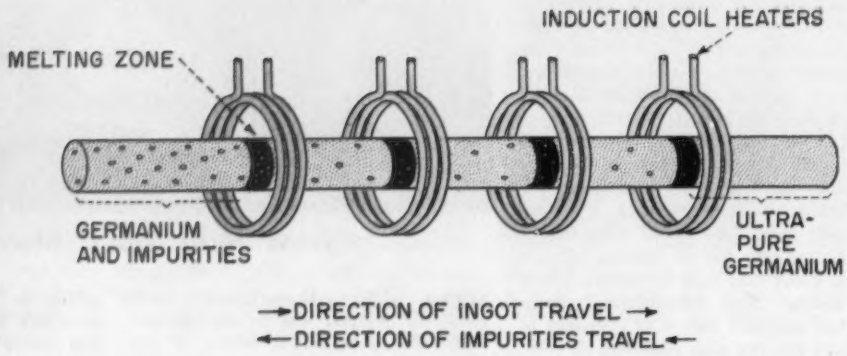
SURFACE MINES produce about 1½ times as much asbestos ore as do those underground and they move about 3 times as much material. ACL's Normandie pit, above, is newest one. Others will add to production in next few years. Equipment preferences are probably influenced by fair amount of selective mining that must be done. Truck haulage has been adopted by all—22-ton, 200 to 300 hp diesel dumps are favored although smaller pits lean toward 15-ton units or 8-ton Dumptors. Several supervisors of larger pits plan for 25% being tied up for maintenance. Good pit roads —some even hard topped—with grades kept down towards 8%, are stressed. Real mucker in larger pit is 5-yd electric shovel; in smaller, 2½-yd diesel.

Benches about 50 ft high are customary. In general, 4 in., plus or minus, air flushed holes are drilled down at 70 deg. to a few feet below grade. Joy's TM 500 is no doubt most popular rig. On high-faces, up to 170 ft, I-R Quarrymasters give good results, percussion drilling 6 in. holes. Toe holes are common. For numerous smaller jobs wagon drills are still useful tools and G-D's AirTrac is being looked at with favor. Semi-portable air compressors are used at one pit to reduce cost of piping from central system. Blasting practice generally involves detonating fuse — especially low-cost B'line — and millisecond delays used with 75% Forceite in bottom and 40% decked above.

WATCH THESE TRENDS

James W. Franklin

William G. Pfann, Bell Telephone Laboratories, Inc.



Passing an ingot through a series of induction coil heaters, each of which produces its own molten zone, results in the migration of impurities toward the back end of the germanium ingot.

How Zone Refining Yields Transistor Grade Ultra-Pure Germanium

ZONE REFINING AND ZONE LEVELING were invented and developed at Bell Telephone Laboratories, Inc., Murray Hill, N. J., by William G. Pfann, 1955 Mathewson Gold Metal Award recipient. We are grateful to Mr. Pfann for his assistance in preparing this article.

GERMANIUM METAL CONTAINING less than one part in 10-billion of harmful impurities is being produced on a commercial basis at Western Electric, manufacturing branch of Bell System in conjunction with the production of single-crystal germanium transistors. Process by which the metal is purified is called zone refining and a variation of this process called zone leveling is used to add the desired impurities to ultra-pure germanium that goes to make a good transistor.

Germanium metal is prepared from relatively pure germanium dioxide by hydrogen reduction to yield a powder, which is melted and poured into ingots, 12 to 20 in. long and about one in. in diameter. Ingot is really quite pure, but due to the fantastic high purity demands of a good transistor, it is called impure germanium metal.

Passing an impure ingot through a series of induction coil heaters, each of which produces a molten zone, causes the impurities to migrate toward the as yet unheated end of the bar. As each part of the ingot passes into a zone, germanium and impurities melt and as the melt moves out of the zone, purified germanium crystallizes at the trailing edge of the melt and impurities migrate into the newly formed melt in the zone. Repeated melting and crystallization at each coil in the unit results in an ultra-pure germanium ingot having almost all the impurities concentrated at one end. Impure end is cut off and the ingot is ready for next step.

Up to a certain limit the more zones through which an ingot is made to pass the purer will be the product. Originally a batch process, experiments are being conducted on continuous processing of chemicals at BTL. In the continuous process, chemical to be refined is fed to a melt-zone from above and ultra-pure product crystallizes out in one direction, while impurity-enriched material moves out of the zone in the other direction.

Now that an ingot has reached the ultra-pure state the germanium must be alloyed with certain elements from either Group III or Group V before it will function in a transistor. Amount added to the ingot is of the order of one part in 100-million parts germanium. The polycrystalline ultra-pure ingot is placed in a boat and a single-crystal seed is added at the lead end of the ingot, along with an alloy pill containing the desired amount of antimony or indium. Initial melting takes place at this lead end and the zone is made to traverse the ingot by pulling the ingot through the induction coil.

As the zone travels along the ingot there freezes out behind it a solid, whose antimony concentration is always proportional to that in the zone. Because the proportionally constant of antimony is very small (only about 0.007), little antimony is lost by the moving zone. Antimony concentration in the zone and in the solid remain essentially constant. When the zone reaches the end of the ingot it begins to contract, causing antimony concentration to rise. This deviation from uniform distribution is limited to a small region and about 85% of the now single-crystal ingot is transistor material. This process is known as zone leveling and is an important modification of zone refining.

Processes and their variations as described above are being developed at BTL to produce the transistors and semiconductors that have revolutionized modern communication equipment design. They have been used to produce silicon, for rectifier use, with less than one part per billion of harmful impurity. In the field of pure and applied research, zone refining and zone leveling have opened the door to new and sometimes fantastic developments; as in the case of rectifiers and transistors. Many new elements are being tested. With the coupling of vacuum melting and zone refining, industry can look forward to new alloys and greatly improved metals.

PERSONALS

American Zinc, Lead & Smelting Personnel Changes

ORGANIZATIONAL CHANGES announced by American Zinc, Lead and Smelting Co., include the following: **William J. Matthews Jr.** (left), secretary-treasurer since 1948, has been elected vice president and treasurer. **Clarence V. Burns** (center), assistant secretary-treasurer since 1948, has been named vice president and controller. **George L. Spencer Jr.** (right), general superintendent of the East St. Louis operations of American Zinc Co. of Illinois, has been named vice president of that company. Other personnel changes include **Ralph C. Perkins,** chief counsel for American Zinc, Lead & Smelting, named secretary in addition to his other duties. **John R. Griffiths** has been named director of industrial relations for the company and its subsidiaries. **L. P. Davidson,** general superintendent, Electrolytic Div., American Zinc Co. of Illinois, has been promoted to manager of the division, and is succeeded by **Thomas I. Moore,** assistant superintendent.

James B. Chaney, mine superintendent, Magnet Cove Plant, National Lead Co., Malvern, Arkansas, has been transferred to the home office of Baroid Division, Houston, Texas, as production assistant.

John H. Dismant, former assistant research metallurgist, Washington State College, Pullman, Wash., has received his Ph.D. in metallurgy from the University of Utah, and established a consulting office in Grand Junction, Colo., known as Metallurgy and Mining Services.

Daniel C. Shewmon has been promoted from plant engineer of Traiee Colliery, to industrial engineer, Semet-Solvay Division, Allied Chemical & Dye Corp.

Kefton H. Teague has joined the industrial minerals division of International Minerals & Chemical Corp. as geologist under the supervision of **Frank R. Hunter,** division geologist. Formerly he has been employed by the U. S. Geological Survey and the Tennessee Valley Authority.

R. W. Maki, of Negaunee, Michigan, project engineer for Jones & Laughlin Steel Corp., has been promoted to resident engineer.

Richard F. Moe of White Pine Copper Co., has been elected chairman of the Upper Peninsula Section, AIME.

Pickands, Mather & Co. has announced the following personnel changes at its various Gogebic Range mines: **R. L. Jose,** superintendent, Anvil mine, has been made superintendent of Mauthe mine. **Lawrence G. Woodworth,** mining captain at Newport mine, has been named assistant superintendent, Mauthe mine. **Leonard Beissel,** assistant mining captain, Anvil mine, has been promoted to mining captain at Mauthe mine. **Kenneth MacDonald,** operating engineer, Newport mine, has been named mining captain at Mauthe. **Albino J. Ciqallia,** mining captain, Sunday Lake mine, is now assistant superintendent, Anvil mine, **R. Tregembo,** mining engineer, Cary mine, is now assistant mining captain at that mine. **O. Vispi,** engineer, Anvil mine, has transferred to Cary mine as mine engineer, and **L. E. Anderson,** operating engineer, has been named mining captain at Peterson mine.

Russell W. Mumford, vice president and consulting engineer for American Potash & Chemical Corp., has retired after 35 years with the company. In 1941 he was named vice president and in 1947, was elected a director.

Henry T. Mudd, president and director of Cyprus Mines Corp., has been elected a director of the Southern California Edison Co.

G. R. Kennedy, former vice president and general manager, Navajo Uranium division of Kerr McGee Oil Industries, Inc., Oklahoma City, Okla., has resigned to become consultant for Rio de Oro Uranium Mines, Inc., and other firms, with headquarters in Albuquerque, N. M.

Clinton Miller, mine superintendent of Appalacian Sulfide in South Stratford, Vermont, is leaving to go with a subsidiary of St. Joseph Lead Co.—Compania Minera Agular, S. A., at Tres Cruces, Province de Jujuy, Argentina.

Dooley P. Wheeler, mining engineer of Salt Lake City, has been named vice president and general manager of the newly-formed Umont Mining, Inc. President of the company is **L. P. Evans Jr.** Mr. Wheeler resigned recently as western exploration superintendent for American Metal Co. Ltd.

Hubert C. Smith has been elected vice president in charge of operations, Eastern Division, Colorado Fuel and Iron Corp.

Louis Lippa, director of the company since its inception, has been elected president of Apex Smelting Co., succeeding **Robert K. Beck,** resigned.

Albert G. Noble, Admiral USN, Ret., has been named a vice president of Vitro Corporation of America. At the same time he was elected to the board of directors. He was formerly executice vice president of Nordberg Mfg. Co.

H. C. Meyer, chairman of the board, Foote Mineral Co., has announced his retirement as chairman and board member, after 50 years of service with the company. Joining the company as mineralogist in 1906, Mr. Meyer became president in 1936, and chairman of the board in 1952. He will continue in an advisory role with the company.

PERSONALS *(Continued)*

JOHN J. FORBES, director of the U. S. Bureau of Mines since 1951, has retired after 40 years of Federal service. He joined the Bureau in 1915 as first-aid miner. In 1927 he was named supervising engineer, Safety Division. Throughout his career, Mr. Forbes has emphasized the need for safety education in the mines.

Robert B. Brackin, beneficiation plant superintendent, Kaiser Steel Corp., Eagle Mountain, Calif., has resigned to join the du Pont Co., in Wilmington, Del., as senior engineer doing consulting work in minerals beneficiation.

L. A. Norman Jr., supervising engineer, California State Division of Mines, has joined the staff of Equipment Engineers, Inc., with headquarters in San Francisco, Calif.

New Jersey Zinc Co., has appointed **Donald McKechnie,** superintedent of Franklin-Sterling, mining operation in New Jersey, and **Sterling S. Huyett,** superintendent of the Friedensville operation in Pennsylvania. Mr. McKechnie, employed at Franklin-Sterling for over 36 years, was assistant superintedent. Mr. Huyett was formerly assistant to the general superintendent at Friedensville.

B. H. Sullivan Jr., has been named assistant vice president of Magnus Metal Corp., subsidiary of National Lead Co.

Climax Molybdenum Co. has appointed **Edwin J. Eisenach** general superintendent of mining and milling operations at Climax, Colo., properties. **John M. Petty,** formerly mine superintendent, succeeds Mr. Eisenach as assistant general superintendent. **William F. Distler** will succeed Mr. Petty.

Carl L. Swenson, president of Foley Brothers, Inc., recently awarded the contract for construction of the $2-million port works at Ilo by Southern Peru Copper Corp., has arrived in Lima. **Harry C. Frankmann** has been named project manager for the Ilo port works. Other members of the staff now in Peru are **Jesse Kasnitz,** named manager of the Lima office, and **Alan Porter,** project engineer.

Warren Smith, pit superintendent, Lavender Pit operations of Phelps Dodge Corp., Bisbee, Ariz., has been named mine superintendent developing the Toquepala mine for Southern Peru Copper Corp.

Thomas Elliott has been named secretary-manager of the British Columbia and Yukon Chamber of Mines succeeding **Frank E. Woodside,** retired. Mr. Woodside will continue in a consulting capacity. Mr. Elliott formerly was his assistant.

Dr. Boris J. Kochanowshy, consulting engineer and faculty member in mining engineering, Pennsylvania State University, has returned from Germany where he was doing research in blasting and consulting work with Rheinische Kalksteinwerke Co., Wulfrath, Rhineland, the world's lagest lime producer.

J. W. Still has resigned as general superintendent, Miami Copper Co., to join with his son, **Arthur R. Still,** in the consulting mining engineers and geologists firm of Still & Still, Prescott, Arizona.

William M. Reed of Seattle, Wash., has been assigned to Anaconda Mining Co.'s Northwest exploration office in Spokane, Wash., in charge of the company's Alaskan exploration work.

Neil Plummer, metallurgical engineer, Utah Copper division of Kennecott Copper Corp., has been named chairman of Utah Section, AIME, succeeding **J. M. Ehrhorn,** manager of industrial development department, Western operations, United States Smelting Refining and Mining Co. **D. F. McElhatten,** manager, Salt Lake district, Mine Safety Appliances Co., was elected vice chairman.

James Beaumont has been named laboratory manager of Pick Laboratories, Saratoga, Calif. **Dr. Leo J. Miller,** former AEC geologist has joined the staff and is conducting exploration work on the mining claims held by Pick Mining Co., a subsidiary of Pick Enterprises.

William H. Rea has been elected a director of Crucible Steel Co. of America, filling the unexpired term of the late **M. Crouse Klock** of Syracuse, N. Y.

A research fellowship has been established by International Nickel Co., Inc., at the University of Michigan which has awarded it to **Charles M. Hammond,** Ann Arbor, Michigan. A graduate of the University, he holds a Master's degree in Metallurgical Engineering and a Bachelor's degree in Chemical and Metallurgical Engineering.

University of Pittsburgh Schools of Engineering and Mines have added eight new teachers to the faculty: **George O. Manifold** has been appointed professor of mechanical engineering. **Kent R. Johnson, Donald E. Rathbone,** and **Ting-Hsin Chin** have been named assistant professors of electrical engineering. New instructors are **Chester C. Kisiel,** civil engineering: **Karl B. Schroedel,** industrial engineering. and **George Saliba** and **Theodore W. Mishtal,** mechanical engineering.

JAMES F. KING has been named assistant to the president of Freeport Sulphur Co. A graduate of Harvard, Mr. King has held post with various Government agencies including Central Intelligence, Defense Production Administration and the Department of Defense, assisting Army secretaries Royall, Gray and Pace.

Hugo Simon of Barth Smelting Co., Inc., was recently honored at a testimonial dinner of the Iron and Metals Division of the Joint Defense Appeal.

St. Joseph Lead Co. has announced the following retirements on pension: **James C. King,** motor driver, Hunt mine; **Michael B. Florian,** supervisor of track crews at Bonne Terre mines; and **Charles E. Elders,** special service shop in Desloge.

Albert J. Fitch, general superintendent, New Mexico operations of the Anaconda Co., has been promoted to assistant manager of New Mexico operations. He joined the company in 1951.

Frank C. Ogden has been named assistant director of ODM for materials, succeeding Wilson S. Floyd.

Wallace P. Major has been appointed pit foreman at Parcel Three mine, M. A. Hanna Co. **Albert Rudolph** has been promoted to plant foreman at the Douglas mine. Mr. Major joined the company in 1942, and Mr. Rudolph joined in 1941.

Ernest R. Dondorf, manager of metal purchases for National Lead Co. since 1939, was honored recently on the occasion of his 49th anniversary with the company.

No "babying" needed here! U. S. Rubber Engineers designed this premium quality hose with more than enough brute strength and stamina to withstand the *highest* working pressures, the *toughest* construction conditions.

And U. S. Matchless® has *proved* its ability to take both use and abuse *indefinitely*—on jobs around the world—serving long after ordinary hose has been ruined by abrasion, crushing and high pressure.

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Mechanical Goods Division

United States Rubber

PERSONALS *(Continued)*

Howard Steven Strouth, chief of the mining division, Standard Ore and Alloys Corp., has planned a trip to Johannesburg to speed up mechanization of the company's Palmiet Chrome Mine in the Transvaal.

D. M. Kentro has joined the Shattuck Denn Mining Corp. as assistant to the vice president. Mr. Kentro had been with the AEC, as assistant director for domestic production, Division of Raw Materials.

John M. Keizer, Nevada mine operator and consulting engineer, has returned to Lovelock, Nev., from a trip through mining areas in Japan, Korea and Malaya.

Clarence R. Knous, assistant division comptroller, Nevada Mines division of Kennecott Copper Corp., McGill, Nev., has been named division comptroller, Ray Mines division, Ray, Arizona, succeeding **Clare L. Billing.**

Paul T. Allsman, assistant regional director for metals and minerals, Eastern Region, U. S. Bureau of Mines, has been named chief mining engineer, succeeding **Eugene D. Gardner,** who retired earlier this year. Prior to joining USBM in 1936, Mr. Allsman worked for United Verde Copper Co.

Edward R. Scammell, plant superintendent for Consolidated Mining and Smelting Co., Trail, B. C., has been named Garfield plant manager for Western Phosphates, Inc., succeeding **E. I. Lentz,** named vice president and general manager.

Frank J. Maloit has been named Western manager of mines, New Jersey Zinc Co., with headquarters at Gilman, Colo. He was general superintendent, Empire Zinc Division.

W. P. Johnston, former field geologist for the New Jersey Zinc Co., has set up a mining geology consulting practice in Reno, Nevada.

Howard I. Young, president, American Zinc, Lead & Smelting Co., was named director of National Assn. of Manufacturers.

OBITUARIES

Norman Carmichael, 89, former general manager for the Old Arizona Copper Co., Morenci, which was later acquired by Phelps Dodge Corp., died November 15 at Rancho Santa Fe, Calif. Credited with being responsible for much of the mining progress in southeastern Arizona, Mr. Carmichael was former governor of the Arizona chapter, American Mining Congress, and received the AIME Legion of Honor award in 1947.

Leslie R. Margetts, 73, superintendent of the Washoe Sampler, The Anaconda Company, died October 13. Mr. Margetts started working at the Washoe Sampler in 1903 and became superintendent of the plant in 1911.

Reginald W. Edmonds, 60, staff engineer, Division of Raw Materials, U. S. Atomic Energy Commission, Washington, D. C., died August 23 at Hanover, N. H., following a long illness. Mr. Edmonds was an exploration engineer with U. S. Smelting, Refining and Mining Co. for 23 years prior to joining the AEC.

Samuel J. Craighead, 57, retired vice president and general manager, United States Fuel Co., died November 16 at Salt Lake City, Utah, following a heart ailment.

Roy Barclay Wilson, 55, president of the Duncan Mining Co. in Graham County, Arizona, died November 16 at Phoenix. He was a widely-known mining figure in Arizona.

Walter W. J. Croze, 84, retired mining engineer, Oliver Iron Mining Co., died November 23 in Duluth, Minn. A graduate of the Michigan College of Mines, now known as the Michigan College of Mining & Technology, he joined Oliver Iron Mining in 1895.

John L. Foote, formerly of Duluth, Minn., died December 2, following a heart attack in Boulder, Colo. He was associated with the University of Colorado. Prior to that he was with the northern ore mines of Republic Steel Corp.

Alvin A. Smith, 50, superintendent of mining operations for Four Corners Uranium Corp., and general superintendent of Silver Bell Mines Co., Ophir, Colo., died November 26. He was stricken with a cerebral hemorrhage while out in the field in his car.

APPRECIATION

Max Schott

THE MINING AND METALS industries lost one of their outstanding pioneers and steadfast good friends November 10, 1955, with the pasing of Max Schott, member of the board of directors and retired president of Climax Molybdenum Co.

Max Schott, my dear friend, business associate and former boss, was gifted with the indomitable curiosity that makes men pioneer. Search for new knowledge, new materials and better ways to do things was an innate part of his nature from the time of his birth in Russelsheim, Germany, on March 15, 1876, until his death in New York, N. Y., nearly 80 years later. It caused him to struggle for a basic education when his farmer parents died before his sixth birthday. It caused him before his seventeenth year to migrate from Germany to America where he was virtually without a friend. It caused him to educate himself at night school (New York University) in metallurgy and law while picking up English and Spanish and working as a clerk in the offices of American Metal Co., Ltd.

With American Metal, Max Schott learned the mining and milling of nonferrous metals from underground up. From office boy at a wage of $7.50 weekly, he rose to important executive positions and service on the board of directors with that company.

By 1917, Max Schott had worked his way through the ranks to managership of the American Metal Co.'s Denver, Colo., office. It was there that he became interested in molybdenum. Up to that time, the present day strategically important metal had been nothing more than a laboratory curiosity and now famous Bartlett Mountain was believed commercially valueless. It was because of his faith in the future value of molybdenum and at his instigation that Climax Molybdenum Co. was organized. He agreed to become its first general manager in the early formative years of the company, and was elected president in 1930.

Under Max Schott, molybdenum became important the world over as one of the foremost alloying materials for iron and steel, and the operations on Bartlett Mountain began to develop into what was to become the largest underground mine in North America. With his leadership, great strides were made in mining and milling methods, strides adopted by mining operations all over the world.

But Max Schott will be best remembered for his dealings with men. His understanding and appreciation of the American system of government was deep and sincere. He believed in the rights and the dignity of the individual and he fashioned his life and management policies on these beliefs.

Although Mr. Schott retired as president of Climax in 1946 at the age of 70, he continued to serve its board of directors as a consultant until his death.

Max Schott is missed by a host of friends in every walk of life. Men come and go, but true pioneers are irreplaceable.

Dennis F. Haley
Retired Vice President
Climax Molybdenum Co.

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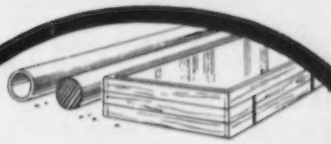

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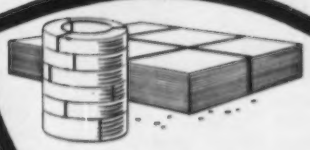

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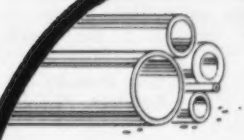

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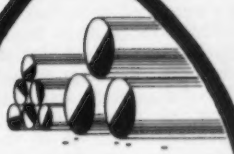

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Letters

Continued from p 4

Further Comment

I read with mixed feelings the following paragraph contained in your editorial, "Engineering in the Outfield."

"The almost frantic search for major league mining talent now going on indicates that there has been little long range training being given by the mining companies to potential management material. Frankly we don't understand why this should be true in an industry whose resourcefulness in solving other problems in its field frequently borders on the miraculous."

As an admittedly uninformed observer, though none the less interested, the disinclination of some of the sizable operating mines of at least one of the largest domestic mining companies to accept the validity of IBM equipment somehow neither strikes me as bordering "on the miraculous" nor as being a sign of "resourcefulness." This is not so disturbing as one inference that might be made. That is, that such a disinclination may be indicative of other similar goings on elsewhere in the industry. Therefore, I for one accept your use of "frequently" with some hesitancy.

Keith Martin
Tucson, Arizona

• There are many areas in which the mining industry exhibits the antithesis of progressive thinking. These shortcomings, however, do not detract from the industry's achievements which have been many and spectacular. The profitable mining of 0.5% copper ore, development of the Frasch process, extraction of nickel from the laterites are a few examples.—Ed.

Lithium Heat and Coal

Re Lithium Article, (*E&MJ* September 1955, pp 75-89) this article states in part "In the field of propulsion, lithium is described in textbooks as being capable of releasing heat in amounts equal to 4,000 tons of coal per pound of metal when used as a solid fuel." Several people have quoted this fuel value to me and consider since they read it in your magazine, it must be correct. I refuse to believe it, in this case, even though I normally consider your magazine to be authoritative.

I assume there must be some mixup between lithium as a nuclear fuel and lithium as a plain chemical fuel. Would you have this matter checked and set everyone straight on the actual facts?

R. Deane
Trail, B. C., Canada

• Mr. Deane is right and here is what Dr. William G. Pollard, executive director, Oakridge Institute of Nuclear Studies, has to say about the matter:

If you will refer to that article (*Mechanical Engineering*, June 1946, Vol. 68, p 509) you will see that my use of the lithium-hydrogen example was purely by way of giving emphasis to the magnitude of the energy released in nuclear processes. The article itself asserts quite emphatically that there is no practical application implied in the example used.

As to your question, the example refers to the reaction:

$$Li^7 + H^1 \longrightarrow 2He^4 + Q$$

Since one electron volt per lithium atom corresponds to 23,000 calories per mole lithium, this represents a reaction heat of 57×10^{11} calories per gram or 10^{11} Btu per pound of lithium-7. A moderately good coal will give a heat combustion of 12,500 Btu per pound or 25-million Btu per ton. Thus it would require 4,000 tons of coal to yield the same amount of heat as the 100,000-million Btu which would be liberated if it were possible to react one pound of lithium-7 with ordinary hydrogen to produce helium. The practical possibility of doing this, however, was specifically denied in my article of nearly ten years ago. I am still rather much inclined to the same opinion.

Four Year Battle

This is a story of a four year battle by, not between, one lone unknown individual against a world reknowned fighting organization having 179 years of glorious history of real fighting. To oppose such a built-in reputation is the handicap and the challenge that I, the lone individual, accepted four years ago. It is not that fighting organization that I oppose but the Bureaucratic bungling of individual stinkerism, incompetence, just plain stupidity, and the original and seven copies of Bureaucratic red tape.

In the Navy's attempted activation of the proposed 3,026,000-acre Black Rock Desert Naval Aerial Gunnery and Special Weapons Testing and Training Range of northwestern Nevada, Navy, afer 5½ years of planning this range, does not yet have Congressional approval of its plans. Navy does not yet have the proper authorization for its proposed uses of the area already selected and in use as the gunnery range site. There is no appropriation of funds to pay for all or any part of the lands already taken or to be taken.

All of this and yet Navy filed condemnation proceedings against me and my Twin Buttes Mine, obtained a Federal District Court Order granting Navy immediate exclusive possession of my property, and evicted me from my home of fifteen years without even posting the just compensation required by the Court in such cases pending Court action and decision. I was not notified of, nor was I present at, the Court hearing which in effect denies me the use of my home, my business, and the net gains of 28 years of my adult life's work—I have not yet been to Court. Navy has made $9.26 per month available to me to compensate temporarily for the loss of just about everything that I possess except for my dog and my jeep truck.

I ask only for the consideration guaranteed every citizen by our Constitution. My protests are ignored.

To sum up—this is not a bid for sympathy. This is a simple statement of what has already happened to one individual and what could happen to anyone if corrective measures are not applied now. Space does not permit presentation of my views concerning the relative merits of Navy's choice of site, that is a matter to be considered by Congress when and if Navy applies for permission to do what it has already done.

Emil Heineke
Lovelock, Nevada

• Apparently industry organizations and Government officials are becoming aware of situations like Mr. Heineke's. See p 75 of this issue, p 85 and 108 of December 1955 *E&MJ*.—Ed.

Asbestos Mines

Continued from p 103

Problem of limiting cave is being tackled with a cut-off slot on side facing property line, both on the sub-level and on the main level below in another block. Slot is a narrow shrinkage stope, mined up on an 80 deg angle to 80 ft high for length of block. Long up holes were used on sub-level portion completed but future plans call for drilling 45-ft long horizontal holes from raises.

One feature noted at this property was the absence of rails in floors of scrams. Considerable testing of various patterns led to the belief that it is less costly to simply omit them and repour floor when worn.

Bell Mine workings at present time are "L" shaped in a corner of the property. Main haulage is about 150 ft from property lines. Secondary haulage drifts turn off at right angles toward property line every 100 ft. Along the secondary haulage drifts a pair of loading chutes are located every 50 ft. Each chute raise splits just above the level each half going to a grizzly chamber on grizzly level 57 ft above rail.

Grizzly drifts are 50-ft apart and are parallel to secondary haulage drifts. Two grizzly drifts are centered. over one haulage drift. Grizzly chambers are spaced on 25-ft centers along the drift. From grizzly chamber (or cabin) two drawholes go up to under cut level 27 ft above. Draw cone has 35-deg bottom leading onto grizzly but where it forms sides of pillar over grizzly drift it slopes back at 60 deg.

Two safety devices that reduce blasting hazards are noteworthy. An automatic siren is hooked up to the blasting switch, and power connections must be made by hooking cable across drifts so as to form a barrier.

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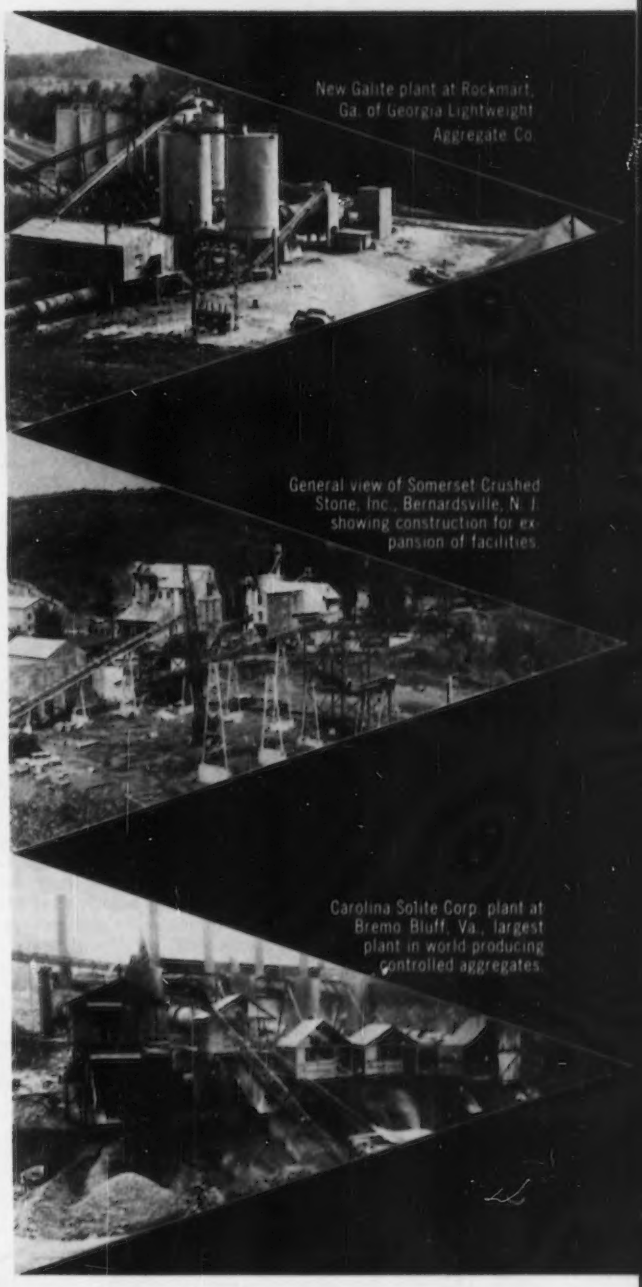
CEMENT, LIME, AGGREGATES

What some manufacturers class as "extras" are *standard* with KVS Machinery and Equipment...world-famous for low maintenance costs, peak capacity and dependable, economical operation under the most severe conditions.

We build a complete plant or a single machine to meet any requirement. Years of experience in successful installations, the world over, have established Kennedy Machinery as the *standard* of comparison. Research and progress *never stop* at KVS.

If you manufacture cement, lime, aggregates or process non-metallic minerals, KVS builds equipment designed to do a *better job,* at lower cost.

Engineering consultation available, anywhere, at any time. Before you specify, let KVS engineers help you select the equipment best suited to meet your requirements.



New Gallte plant at Rockmart, Ga. of Georgia Lightweight Aggregate Co.

General view of Somerset Crushed Stone, Inc., Bernardsville, N. J. showing construction for expansion of facilities.

Carolina Solite Corp. plant at Bremo Bluff, Va., largest plant in world producing controlled aggregates.

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OPERATING IDEAS

SIMPLE rig is used at Levack Mine.

HOLE is cut with 20-ft core barrel.

STEEL shot is poured to cutting shoe.

Calyx Drill Cuts Fill Raise at Inco

USE OF CALYX DRILL to make vertical openings may be "old hat" for some but it still is fast and low cost. Inco recently used one for the first time. Hole delivers gravel fill to empty blasthole stopes at their Levack Mine. As much as 18 ft of 3-ft core was cut in one day. Total depth is 308 ft through norite.

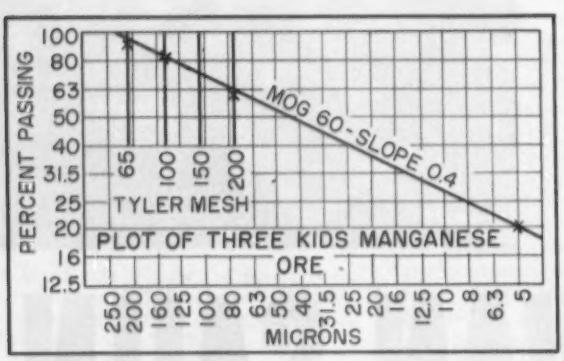
The Calyx core drill, sometimes called a shot drill, was introduced from Australia about 50 years ago. Bit of drill, attached to 20-ft core barrel, was rotated with 4-in. sectional pipe driven by 160-hp diesel. Bit was made of mild steel rolled into cylinder. Several inclined slots are cut into lower edge. Chilled steel shot is fed into pipe along with water and carried down inside surface of bit, then out through slots and under cutting edge. Weight of barrel assembly on shot gives cutting action. Water flow is adjusted to remove rock cuttings to a calyx or sludge receiver at top of barrel without carrying off heavier shot.

Ring cut is 2½ to 3 in. wide. When core barrel is filled, core is cut off by wedging or blasting and then lifted out for disposal.

Big hole is located about 1 mile east of No. 2 shaft. Fill is dumped into hole from railway. Chute to hole is steel plated concrete. Water, sprayed on at dump, is used to make fill spread at flatter angle in stopes.

FILL, sprayed with water is dumped down hole to empty stopes.

Gravel for fill is taken from pit west of Levack. The 25-cu yd cars are dumped by compressed air supplied from the 80-ton locomotive. Trains consist of 8 cars.



Graph Checks Overgrinding

OVERGRINDING may be wrongly taking the blame for your milling problem. A. O. Gates of Utility Engineers Inc., Salt Lake City, Utah, claims to have a simple way of checking whether you are overgrinding or not. He states that for finer sizes (minus 65 mesh) the normal graph is straight-line when a logarithmic scale is used for "percent passing" ordinate and an even spaced ordinate is used for size (microns).

As his letter says, "In the Journal for November 1955, Mr. J. B. Huttl's 'How Manganese Inc. Upgrades Complex Three Kid's Ore,' page 93, gives an average screen analysis followed by 'because of the extreme friability of the manganese minerals, as much as 20% of the classifier overflow has been found to be minus 5 microns.'

"As I always plot screen analyses where and when found, the accompanying graph shows characteristics anticipated.

"There is no 'overgrinding.' When ore or rock is broken, the zones of break produce all sizes down to minimum grain size (probably the molecule), following a law of size distribution which shows up as a straight Mesh of Grind line in the finer sizes. This simple logarithmic plot indicates persistence as a straight line into the less than 1 micron size, and there is nothing indicating any slope change beyond that point.

"The slope of 0.4 shown is not uncommon; it is characteristic of that particular material from that particular orebody. Manipulation will not change it. It is evidently the most important property of crushed rock in the calculation of surface."

How to pick the **RIGHT RIG** *for your job*

Alberhill Coal and Clay Company selects its equipment carefully. The firm bought two Caterpillar DW21s after comparison demonstrations with other makes in their clay pit at Alberhill, Calif. Are they glad they chose Caterpillar? Listen to Harvey Gardner, superintendent:

"We've moved as much as 3480 bank yards in a nine-hour day with these two rigs, over a half-mile round-trip haul. The material was firebrick clay—so hard that it had to be ripped." The CAT* DW21s were push-loaded by a D8 Tractor.

This DW21's performance speaks for itself. However, you can count on even bigger loads in less loading time with the new DW21 (Series C) and the new No. 470 LOWBOWL Scraper. This rig incorporates time-tested Caterpillar features with advance design improvements, packs 300 HP at 1800 r.p.m. and has a capacity of 25 cu. yd. heaped, 18 cu. yd. struck.

As a result of comparing equipment carefully, Alberhill Coal and Clay Company is now standardized on Caterpillar. The firm owns five Caterpillar track-type Tractors, a Caterpillar Motor Grader and a D13000 Diesel Electric Set in addition to the two Cat DW21s. "We've had very little down time," Superintendent Gardner says, "and we get fast and efficient service from our Caterpillar Dealer."

Get all the facts. Your Caterpillar Dealer will gladly demonstrate—on your job—the tractor-scraper combination that will move the most material for *you* at lowest cost. Give him a call today.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

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NAME THE DATE... YOUR DEALER WILL DEMONSTRATE

PREVENTIVE maintenance to fit the season will keep the job humming along.

How To Whip Winter

HEAVY EQUIPMENT is designed to operate under conditions far from ideal, and those conditions most commonly occur in cold weather. Therefore, with a little forethought and planning, machinery can operate satisfactorily regardless of the intensity of the weather.

Leaking radiators, hoses, water pumps or gaskets are an invitation to trouble when the temperature drops. In addition there is the fan belt which is so often neglected—it's very important in winter if it drives a water pump. Stretched and frayed from the summer's heat it may turn its last on a zero day.

If your machine is on vacation this winter, keep the engine rust free with a cup of crankcase oil poured into each cylinder once a month. Crank the engine a few turns with the compression off at least once a week to restore the oil film on the cylinder walls. The same treatment goes for the starting engine, a couple of tablespoonsful of oil is sufficient.

Water in diesel fuel creates no end of trouble in any weather and as the temperature drops it causes freezing of the lines and filters. Properly stored fuel contains practically no water but when refueling machines in snow or rain, some water can enter the fuel tank. Fill the fuel tanks at the end of the day's operation to drive out the moisture laden air and drain off a quart or so before starting the next morning. The accumulated water, if not frozen, can be eliminated.

The gasoline starting engine can be a very dependable starter in any temperature if it is kept in condition. Valve and cylinder equipment must be good, otherwise hard starting or insufficient cranking power result. Avoid overchoking and fast idling speeds to promote longer life during low temperature operation. If the starting engine has a two-speed transmission, make full use of the lower speed gears when cranking a cold engine.

Replace any missing drain plugs and gaskets in steering clutch enclosures and dry flywheel clutch compartments. When operating in mud or water, these compartments can accumulate debris and mud which may freeze and cause serious damage to the working parts.

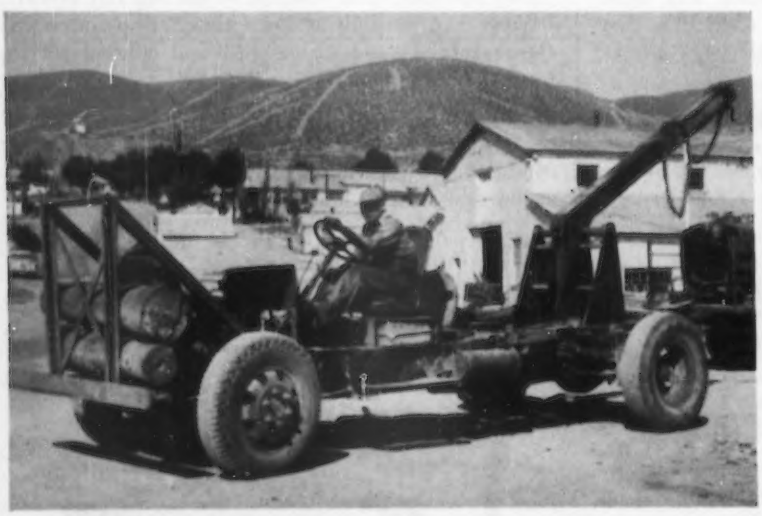
Transmissions and final drives should be flushed and refilled with fresh oil of a lighter grade, generally SAE No. 80.

Tracks, track rollers and carrier rollers require some additional attention also in cold weather. Snow frequently packs between the rails of the tracks, causing excessively tight tracks. The best solution here is the installation of special snow track grousers. These plates have holes in their center which eliminate packing.

Track hardware is subjected to tremendous stresses if a tractor becomes frozen in mud. Never park a machine where there is danger of freezing the tracks to the ground. A simple log berth for the machine will prevent freezing of tracks and will relieve an operator of a lot of work when the machine is to be moved.

Frozen mud around the rollers and carrier rollers lock them tight. If a machine is run any distance with frozen rollers, the track rails rub over the rollers, wearing flat spots on them, rendering the roller practically useless. Cleaning the track assemblies prior to parking the tractor will lower repair costs. This is a dirty task, but it's much easier than freeing a frozen roller.

These pointers were supplied by Caterpillar Tractor Co., Peoria, Ill.



Handy Use For Old Dump Truck

SERVICE UNIT shown here was made from old end-dump truck by C. T. Young, pit boss at tungsten mines of Nevada-Massachusetts Co., Tungsten, Nev. Called the Scorpion, it is used for lifting and pushing stalled trucks, shovel booms, etc. Pivoted steel boom capable of lifting 5 tons is actuated by hydraulic system meant for dumping. Auxiliary hoist arrangement immediately behind driver's seat can lift 1 ton and is powered through geared-up and flywheel-equipped truck starter unit. Sturdy front bumper is made from old rails.

Swift...Sure...Safe...
Gardner-Denver GD10 Mine Car Loader

Swift... Big Dipper (4¾-cubic-foot capacity) mucks out fast . . . loads your big mine cars heaping full.

Sure... Engineered to go underground and stay. Only 2 points to oil regularly.

Safe... Low center of gravity and high flange wheels for stability on the rails. Naturally positioned controls . . . quickly and easily moved to either side. Write for additional information.

Another big capacity Gardner-Denver loader — the GD14 — loads at the rate of 2 to 3 tons per minute.

In smaller headings, Gardner-Denver GD9 loads out at the rate of 1 to 2 tons per minute.

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THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

Gardner-Denver Company, Quincy, Illinois

In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Ave., Toronto 16, Ontario

NEW MAPS

Canadian Plastic Relief Map

Combining data obtained in 500,000 miles of airborne magnetometer surveys, existing maps of the area, information from the Canadian Department of Mines and Technical Resources, surveys from the office of the Surveyor General with the information collected by the Canadian Army Survey Establishment in plotting over 300,000 miles of the Arctic, Canadian Aero Service Ltd. has come up with a vivid eight color plastic relief map of Canada weighing only 2 pounds.

The map is 49x45 in. on a scale of 1 in. equals 75 miles. Land forms, land use and over 3,000 place names are included. New and previously unpublished information, gained by Canadian Army in Shoran and Dew Line plotting, has been included. Map is up to date through May 1955. Prince Patrick Island has been repositioned some 80 miles from that on older maps. Banks Island has been moved some 20 miles to its correct position.

Local usage prevails in spelling. Mt. Logan, 19,850 ft high, rises one inch above the map surface. Map is latest in series to be produced by Canadian Aero Service Ltd., Ottawa, Ontario, Canada and Aero Service Corp., Philadelphia 20, Pa. Price $45.

MR-2, Map of the Uranium Deposits of the United States, prepared by R. W. Schnabel for Geological Survey on behalf of the Atomic Energy Commission. The more important deposits, other than pegmatites, in continental U. S. have been located, based upon information gained from published and unpublished reports of the AEC, its contractors, Geological Survey, private corporations and individuals. Map is 34x52 in. on scale of about 80 miles to the inch.

Bibliography and short discussion of the prospects for future development are included. Copies may be ordered by mail at 50c each from Geological Survey Distribution Center, Washington 25, D. C. and Federal Center, Denver, Colorado.

Over the counter purchases may also be made, but no mail service, at the following Survey offices: Room 1028 General Services Administration Bldg., Washington, D C.; 807 Post Office and Court House, Los Angeles, Calif.; 724 Appraisers Bldg., San Francisco; 468 New Customhouse, Denver, Colo., and 504 Federal Bldg., Salt Lake City, Utah.

Geophysical Investigation Map 124, Airborne Radioactivity Survey of the Pinto-Chinle Area, Apache County, Arizona, by J. L. Meuschke for Geological Survey. Photomosaic showing radioactivity anomalies detected during airborne survey of 1,700 sq mi in Apache County. Survey was made with a scintillation counter at 500 ft. Map may be ordered by mail at 50c a copy from the same offices as listed above.

Large-Scale Map of Salt Lake City and Vicinity, prepared by Geological Survey. A comprehensive and detailed survey of an important metropolitan area and should be of special value for engineers. One of the standard quadrangles from which this map was prepared, the Fort Douglas sheets, was compiled by the Survey in cooperation with the State of Utah. New Map also includes large portions of three others; Salt Lake City North, South and Sugar House. All four are available as separate 7.5 minute quads.

In five colors on a scale of 1:24,000, copies are available at 75c from Geological Survey, Washington 25, D. C., if east of the Mississippi and from Survey Office, Denver, Colorado, if west of the Mississippi.

• The following maps and reports have been released in open file. Copies are available for consultation at the Geological Survey, Room 1033 (Library), General Services Administration Building, Washington, D. C., and as listed below. Copies are not available for distribution.

Geology of the Edison Area, Sussex County, New Jersey, by D. R. Baker. 275 pp., 18 figs., 20 plates and 24 tables.

Uranium in the Gas Hills Area, Fremont and Natrona Counties, Wyoming, by J. D. Love. A preliminary report in 31 pp. On file at Geological Survey offices, 468 New Customhouse, Denver, Colo., and Geology Hall, University of Wyoming, Laramie, Wyo.

Geology of the Du Noir Areas, Fremont County, Wyoming, by W. R. Keefer. 235 pp., 36 illustrations and one table. On file at the Geological Survey, Geology Hall, U. of Wyo., Laramie.

Quaternary Stratigraphy of the La Sal Mountains, Utah, by G. M. Richmond. 207 pp., 23 figs., 27 plates and 5 tables. On file at University Library, University of Colorado, Boulder, Colo., and at Department of Geology, University of Colorado, Boulder, Colo.

Electrical Resistance Measurements in the Neillsville Area, Wisconsin, by H. C. Spicer and G. J. Edwards. 34 pp. On file at Geological Survey, Science Hall, University of Wisconsin, Madison, Wis.

Preliminary Report of the Geology of Upper La Paz Valley, Bolivia, by Ernest Dobrovolny. One plate, 6 figs. and 32 pp.

Preliminary Report on Part of the Oat Hill Quicksilver Mine, Mayacmas District, Napa County, California, by P. F. Fix. 18 pp. On file at Geological Survey, 724 Appraisers Bldg., 630 Sansome St., San Francisco, Calif.; 807 Post Office and Courthouse Bldg., Los Angeles, and at California Division of Mines, Ferry Bldg., San Francisco.

Compilation Copy of Geologic Map of Part of the Saypo Quadrangle, Montana, by C. F. Deiss. One map. On file at State Geologist, Indiana Geological Survey, Bloomington, Ind.

Surficial Geologic Map of Proposed Route 3 from Lowell, Mass., to the New Hampshire State Line, by R. H. Jahns and others, compiled by J. H. Hartshorn and P. M. Hanshaw. One map. Prepared in cooperation with Commonwealth of Massachusetts, Department of Public Works. On file at Geological Survey, Room 1, 270 Dartmouth St., Boston 16, Mass.

Glacial Geology of the Taunton Quadrangle, Massachusetts, by J. H. Hartshorn. 160 pp. On file at Geological Survey office in Boston, Mass.

The Garm-Lamoreaux Mine, Lemhi County, Idaho, by F. C. Armstrong and P. L. Weiss. 10 pp. On file at Geological Survey, San Francisco, and South 157 Howard St., Spokane, Wash., at Office of Director, Montana Bureau of Mines and Geology, Montana School of Mines, Butte, Mont., and at the Office of the Director, Idaho Bureau of Mines and Geology, University of Idaho, Moscow.

Geology of the Fourmile Pegmatite Area, Custer County, South Dakota, by J. A. Redden. 231 pp. On file at the Library, South Dakota School of Mines.

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- **ALL-DUTY**—The opened-up tread of the new L.C.M. makes it truly an all-duty tire for all type operations. Reduces rolling resistance . . . increases tread life.
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- **EXTRA PROTECTION**—Wider, heavier tread with deep-drive cleats protects sidewalls against cuts and snags . . . puts more rubber on ground for less strain, less stress per-square-inch.

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U.S. Plans Participation at GATT Mineral Tariff Meeting

TARIFFS AND TRADE agreements share the spotlight with Congressional legislation in the mining industry this month. On Jan. 18, U.S. negotiators sit down with representatives of 25 foreign nations at Geneva, Switzerland for the opening of the fourth round of postwar tariff talks by the Secretariat of the General Agreements on Tariffs and Trade (GATT).

Some 1200 U.S. produced items will be included in the bargaining talks, with rate reductions up to 5% in most cases offered in exchange for trade concessions from other GATT countries. A considerable list of mining products—both raw materials and finished goods—is on the agenda.

Mining items include: various pigments and metallic compounds or salts; firebrick; magnesite; gypsum; pumice stone; ball and china clays; mica; talc; marble, granite, and other building stones; manganese ore and concentrates; molybdenum ore and concentrates; tungsten ore and concentrates; ferromanganese; tungsten alloys; ferrosilicon; chromium and ferrochrome; calcium; aluminum and alloys; magnesium; antimony regulus or metal; bismuth; copper in rolls, rods or sheets; metallic arsenic; nickel in pigs, ingots, or cathodes; and import taxes on copper-bearing ores and concentrates.

Also on the list of items are: barytes, columbium, plate iron and steel, metal ropes and cables (except solid gold or platinum chain), and alloys of the following:

Barium, boron, calcium, columbium or niobium, strontium, tantalum, thorium, titanium, vanadium, and zirconium alloyed with aluminum, chromium, cobalt, copper, manganese, nickel, or silicon (except calcium silicon or zirconium silicon).

Both basic suppliers and processors of these items have had their say on the makeup of the bargaining list. The Committee for Reciprocity Information reported to the State Department its recommendations on what items should be put on the list, after a series of hearings over the past couple of months. State Department said the entire list, including the additions made last month (*E&MJ*, December 1955, p. 110), was based on the recommendation and requests of businessmen.

Tariff Commission, on the other hand, has been holding hearings during the same period, to determine peril points on the materials. The U.S. negotiators at Geneva are not bound by peril points—that rate below which the Tariff Commission says a cut would "injure" the domestic "industry." More peril point hearings are scheduled this month on the items added (see last two paragraphs of above list).

At the same time, the Tariff Commission has announced that it may ask Congress for some clarifying amendments to the controversial so-called Anti-Dumping Act of 1954. Commissioners say the wording is "loose," and that the words, "injure" and "industry" are not clear. They have asked their staff to draw up recommendations.

Meanwhile, say Commission staffers, 90% of the industry witnesses testifying at their peril point hearings have opposed any cuts in present rates, and in many cases have recommended higher tariffs.

Among those industry representatives appearing at the recent peril point hearings before the commission were the Tungsten Institute, Nelco Metals, Inc., Revere Copper and Brass Co., and the Drop Forging Association.

Mining Senators Plan Concerted Drive For Stockpile Legislation in New Year

HOTTEST MINING ISSUE on Capitol Hill as Congress plunges into its election-year session this month is the Government's long range policy toward support programs, particularly for small mines. Most of the important new legislation and committee hearings will revolve around this issue, reflecting sharp Congressional criticism of what many mining-state legislators—especially the Democrats—regard as the Administration's failure to come up with a firm long range support program policy.

On the Senate side, Interior Committee chairman James Murray (D-Mont.) will sponsor two specific pieces of legislation aimed at forcing the Government's hand in establishing a standard support policy for each of the basic metals and minerals.

The first, and likely to be the most important, is a joint Senate-House resolution—co-sponsored by Representatives on the House side—fixing the responsibility for support program policy-setting with the Interior Department (see *E&MJ*, December 1955, p 108).

As another effort in the same direction, someone is sure to reintroduce a bill to extend the metal and mineral Government purchase laws. S.922 and later its compromise companion bill, HR.6373 had stormy going last session, with the latter bill getting a veto by the President.

This will have trouble hurdling the pocket veto. One solution will be proposed in the form of "Buy American" act for metals and minerals, setting a fixed percentage above the market price for imports.

Another bill that will be dropped in the Senate hopper with the blessing of Murray and his Interior Committee colleagues will seek to authorize temporary claims for large-area geophysical and geochemical mine prospecting, particularly for uranium. Since these methods of prospecting don't require digging, but flying over the land and surveying it, the bill would permit larger temporary claims, which would be reduced later to the particular area where a deposit was indicated.

Pending bills are few and far between. There are a handful of minor bills on the calendars of both the Senate and House Interior Committees, but none of any wide significance or especially good chance of passage. The consensus on the Hill is that the last session of Congress posted one of the best scores in passing mining legislation in many years—and that except for the veto of metal and mineral Government purchase extension, there's not much holdover work.

Joint Group Hears Tax Depletion Authorities

TAX DEPLETION ALLOWANCES came in for a critical look by the Joint Senate-House Economic Subcommittee headed by Rep. Wilber Mills (D-Ark.) last month. For several weeks the Mills group heard industry and academic experts on tax matters testify on various phases of the nation's current tax policy, including amortization, percentage depletion and incentive allowances.

Industry witnesses in the mining and oil fields were unanimous in recommending that the allowances be kept in force as the best way of encouraging further exploration necessary to meet the nation's materials requirements. Many of the academicians sharply criticised the depletion allowance as a gravy boon to big corporations and investors, some opponents suggested that the allowances stimulated wasteful expansion which drains the country's natural resources unnecessarily.

Climate on Capitol Hill, however, is not conducive to much if any change in the tax laws this coming session. Best guess in Washington is that the depletion allowances will continue in force.

Among mining representatives testifying before the mills committee was American Mining Congress tax committee chairman Henry Fernald. In part Fernald said:

"Determination of taxable income from mineral extraction is a distinctive problem. The mineral sold is part of the capital asset represented by the mineral

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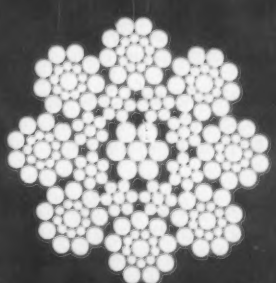
Three characteristics give J&L CenterFit Wire Rope the staying power to develop outstanding service in applications where shock, fatigue, and heavy loading limit the service life of standard wire rope.

1. CENTERFIT is the strongest standard rope produced.
2. CENTERFIT is more flexible in operation than any standard IWRC rope.
3. CENTERFIT has unsurpassed resistance to shock loading.

Over the years CenterFit has built a record for outstanding service life on the toughest applications such as shovel hoist ropes, back hoe pull ropes, and clamshell holding and closing lines where overloading is a factor.

If you're operating where loading, shock and fatigue are severe, chances are J&L CenterFit can help you cut your wire rope costs. Contact your nearest J&L Office or representative.



J&L STEEL

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STEEL CORPORATION — *Pittsburgh*

deposit itself." He declared that, in mining, the mineral that is exhausted is not replaceable and that expenditures to find and develop other deposits are made without knowing what may result. Fernald pointed out that most mineral deposits found never repay the expenditures for them and that our tax laws must recognize, as they do, the problems of the mining industry in order not to impair incentives for mineral production. He warned that if changes in depletion or other tax allowances reduce incentives which are based on expected net return after taxes "we cannot assume, as some do, that activity, expenditures and income will continue the same and greater taxes result." He said we must maintain a vigorous, active and well-equipped and well-trained mineral industry available for emergency, and while we may rightly acquire some minerals from abroad, this country "should not be wholly dependent on foreign supplies which might be cut off or limited in war or in peace."

New Developments

NO MORE WITHDRAWALS of Public Lands for defense purposes until House Interior Committee can hold hearings on overlapping requests by the several branches of the Armed Forces. That's the promise Rep. Claire Engle (D-Cal.) got from Bureau of Land Management chief Wesley D'Ewart, as a result of Engle's request last month. Engle has protested to Interior that some 3-million acres of grazing and mining land had been withdrawn unnecessarily by the Armed Forces. Hearings have been scheduled for 4th and 5th of this month.

•

NICKEL AND COPPER purchases by the Government have been deferred because of the shortage in these metals. Office of Defense Mobilization has called off buys of 4.1-million lb of nickel per month for the first quarter of 1956, including some premium-priced ferronickel and nickel ingot. Copper purchases of 14,000 tons for the same period also have been deferred. ODM said, however, that the diversions of the metals for industry use did not mean that it would release any of either from its stockpiles, which are still considerably below minimum goal requirements.

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ATOMIC ENERGY COMMISSION hopes to buy its beryllium for nuclear reactors from private industry, rather than from Government from now on. This month AEC is inviting industry proposals to supply up to 100,000 lb annually over a 5-year period. The Commission's Luckey, Ohio, plant which has been supplying AEC's needs will be retired to standby status.

Labor This Month

MINE-MILL'S 1956 OUTLOOK: The future of the International Mine Mill and Smelter Workers Union as a bargaining force in the nonferrous mining industry may be settled before the year is out. The 70-thousand member union, a stronghold for the past 65 years, is nearing a climax. Government efforts to disband the union because of Communist-domination will be completed—though the trial may linger in the courts beyond the end of the year. But, should Mine-Mill leaders avoid the Federal crackdown, their union will face attacks from other sources.

An assault on MMSW may come from the newly-combined AFL-CIO. The parent federation won't do the attacking itself. It will hand the reins to a particular union that has jurisdiction in the non-ferrous industry, most likely to be the giant Steelworkers' Union, which has made sporadic raids on Mine-Mill over the past several years—without too much success. With AFL-CIO behind the move, the steel union can make headway.

IMMEDIATE FUTURE BRIGHTENS: While Mine-Mill's long-term fate looks dark, its officials started the year with better prospects than they've had for some time. This is due to a surprise pact with the giant Teamsters Union—a mutual aid pact that will find the two unions side by side against management if a strike occurs.

When Mine-Mill had just about given up hope of tying in with the AFL-CIO, Teamsters' western division agreed on the informal alliance. While the Teamsters are part of the AFL-CIO, it doesn't mean an entry into the parent group for Mine-Mill. AFL-CIO president George Meany says flatly Mine-Mill can't join with its current leadership—and the mine union has no thought of teaming up unless it can do so intact.

The Teamsters made the alliance to aid its own members who drive trucks to and from the mines. Because of the close working relationship between members of the two unions, the Teamsters believe they can put more pressure on management by cooperative efforts. But there are several pitfalls for Mine-Mill, even with the agreement. These are:

- A pledge by the Teamsters that they'll break off the pact if Mine-Mill is found to be Communist-dominated by the courts. But this isn't an immediate threat since it may take several years before a final decision.

- A promise by Teamster's president Dave Beck, that his union will not stand in the way if the AFL-CIO decides to go after the mine union. This means that the Teamsters may not help Mine-Mill in any "raiding" attempt by the steelworkers union.

- If either of these events occur, the Teamsters may well start raiding the mine union themselves. Beck says MMSW has 800 to 1500 truck drivers that belong to his union. Once the mutual aid pact is broken, he'll move in quickly.

BARGAINING THE YEAR AHEAD—COSTLY: All signs point to a rough negotiating year. The business boom, expected to continue through the next 12 months, means unions will be out for a big share. Wage demands will be high. Fringe benefits will also be pushed—with a new emphasis on major or "catastrophic" health insurance to take care of long-term expenses such as tuberculosis and heart disease.

There'll be a strong lever to push up wages through deferred increases due to come up in a number of important industries. For instance, an automatic 6c-an-hour will get delayed raises from 5 to 15c and many Teamster contracts provide for hefty advances in the next 12 months.

Supplementary unemployment payment plans will push ahead. The break-through by the United Auto Workers, which has signed up almost 100 companies under the "sup plan" will swell if the Steelworkers union comes through in 1956. Mine-Mill, which failed on a $60-a-week assured wage last year, will be back again with the same sort of demand in August.

Business Investment Holds Key To Both Growth and Stability

What federal tax policy will best promote both growth and stability in the American economy? The Joint Economic Committee of Congress has been asking this crucially important question in public hearings. This editorial suggests one vital part of the answer.

The proposition advanced here is that—

> Tax policy must encourage a continuing high level of business investment in new plant and equipment, because such investment makes a special contribution to *both* economic growth and economic stability.

Growth Needed for Security

We must have both growth and stability.

A vigorous economic growth is essential to our national security. As Congressman Wilbur D. Mills said in launching the Joint Committee's hearings, "The present complexion of world affairs places a premium upon strength and growth in our national economy." Growth is likewise a major ingredient of a healthy domestic economy. Growing enterprises and growing communities offer far more opportunities for satisfying careers than those which are not growing.

A reasonably stable economy, without violent ups and downs, is also essential to our national welfare. Extravagant booms and their more or less inevitable result, severe depressions, waste labor and resources and cause great human misery. Both major political parties have accepted the obligation imposed by the Employment Act of 1946, that the federal government work to maintain high and stable employment.

There is general agreement that **the key to economic growth is investment in new plant and equipment.** Growth depends decisively on new facilities to increase production, and also to produce new and better products in new and better ways. At the same time, new plant investment provides employment for the important, and well-paid, one-fourth of our industrial workers who manufacture and build new production facilities. So if the process of business investment is kept on an even keel, the result is not only growth but also stability in a substantial sector of our economy.

But authorities disagree on the possibility of maintaining a high level of business investment for any great length of time. Some fear that it will lead to an excess of producing capacity and the glutting of markets, with recession or depression not far behind.

The history of our country offers some basis for the fear that it is dangerous to maintain a very high level of business investment. There have been times when the economy has suffered under the weight of excess producing capacity. **This fear, however, has been made obsolete by the recent course of our economic history which, in its earlier phases, nourished the fear.**

The World Has Changed

Here are some of the major considerations, cited at the Joint Committee hearings, which support the conclusion that we not only *can have* a high level of business investment and economic stability but that we actually *need* a high level of such investment to assure stability.

(1) Over the next 20 years our population is expected to increase by about one-third. But most of the population increase will come in age groups younger or older than normal working ages, and people will probably work fewer hours per week. Thus hours worked are not expected to increase more than 15%. Consequently, we must have a relatively large increase in the amount of production equipment per worker if our standard of living is not to suffer. This means a high level of new investment.

(2) About half of our present business investment goes to replace worn-out equipment, rather than to expand capacity as was true during the early stages of our industrial development.

(3) Thanks largely to the impact of organized research—for which we as a nation now spend about $4 billion a year—a large share of capital investment now goes to provide new products and new processes, rather than to expand existing capacity.

These developments make it unlikely that we shall develop the burden of excess capacity that plagued the economy in earlier periods. **Moreover, most capital investment plans are now made on a long-range basis. Companies are building facilities to anticipate their needs for several years ahead.** This increase in long-range planning has reduced the disturbing effects of temporary shortages and excesses in producing capacity.

The record of recent years speaks for itself. Business spending for new plant and equipment in 1955 was over $29 billion. This continued the high level of investment that has been maintained for the past ten years—a decade remarkable for both impressive growth and gratifying stability. A McGraw-Hill survey of preliminary plans for 1956 indicates another year of increasing investment, and expanding business activity.

Tax policy, to be successful, must consider this impressive contribution of business investment to both growth and stability.

Of course, the level of investment depends on many factors other than federal tax policy. The degree of business confidence is important. So is the strength of consumer markets. So is the attitude of organized labor toward the use of more efficient machinery. But tax policy is a crucially important factor. And it is becoming more so with new developments in our changing economy. These developments indicate that tax policy **must be geared to foster a high level of business investment, if the dual objectives of economic growth and economic stability are surely to be attained.**

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

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Uranium's Future is Strong, Says AEC Official

"URANIUM IS HERE TO STAY" according to Robert D. Nininger, assistant director for exploration, division of raw materials, Atomic Energy Commission, who discussed the present status and outlook for the uranium mining industry before the November meeting of the New York Section, AIME.

Noting that he had predicted "a year of shaking down and consolidation" in the industry (*E&MJ*, February 1955, p 92), Mr. Nininger noted that "this view was rather widely shared, I think, and required no special 'crystal ball.' In fact, it has been borne out by events since."

The AEC official noted that the "boom" slowed because of three major factors: (1) unfounded speculation on the short term prospect of achieving controlled fusion reactions for commercial power; (2) "what I consider inaccurate interpretation of the consensus at Geneva on the potential role of thorium and its effect on uranium requirements." and (3) the increased rate of uranium discoveries and the resultant recognition that uranium supply in the world is probably adequate.

"None of these (factors), I think, are justifiable reasons for pessimism concerning the uranium industry, looking at the long pull," Nininger said. "On the other hand, if they do dampen unhealthy speculation and promotional activities, it will be a good thing for the industry."

The assistant director for exploration discussed the three major factors involved in the "shaking down," noting—in regard to the first that due to the long-range aspects of any break-through in the field of fusion to supply energy, the threat of such a break-through damaging the fission field was remote—"I can see no reason, whatsoever, for concern by any part of the uranium industry, from the weekend prospector to the major mining company.

"Successful utilization of the fusion reaction in industry might have no more effect on the demand for uranium than fission power is expected to have on the need for coal and oil," he said.

Mr. Nininger summed up the current position of thorium as being "no different than it has been for several years. The usefulness of thorium, so far as the Commission's program is concerned, is limited for the present primarily to research." (*E&MJ*, November 1955, p 75.) ". . . although it may have certain specific, limited advantages over uranium for some things, thorium will still be supplemental to uranium, on which atomic power must depend."

Noting that estimates of uranium requirements have had a history of "continual shortening of time and upping of requirements," Nininger said, ". . . it appears to me that we probably have yet no accurate realization of the ultimate size uranium requirements may reach."

TODAY'S problems and uncertainties are the admission to the opportunities of tomorrow, says Robert D. Nininger, AEC raw materials division.

The demand for reactors abroad, as prompted by the Geneva conference and the showing of U. S. models there, is strong and backed by a real need on the part of nations where cost of power is much higher than in the U. S., said Nininger.

Newest major uranium discovery, according to the speaker, which he cited to indicate that exploration is still continuing on a large scale, is the one in the Ambrosia Lake area, McKinley County, N. M., "where several companies are developing the extensive mineralized areas in the Morrison formation north of the Zuni uplift. The extent of these deposits and their ultimate reserves are as yet unknown, but drilling is preceding at a rapid rate and one shaft is nearing completion.

"There seem to be good possibilities of another multi-million-ton ore district, adding to the tremendous potentialities of the Grants-Laguna area, with its Jackpile and Haystack mines."

Discussing the continued intensive drilling by private companies, and the more research-like role being assumed by Government exploration agencies, Nininger said, "As the outcropping and near-surface orebodies become exhausted, and new geologic information is gained, long range programs . . . in search of deeply hidden orebodies, will assume greater importance. This will probably result in a decrease in the number of successful individual prospectors and small companies. . . . The factors that have always been important in the exploration for and mining of other metals will undoubtedly assume greater importance in the uranium industry.

"Uranium can no longer be considered a rare metal. Yet this makes it no less valuable to the future development of the country and the world. Although success may be more difficult, and the unskilled and unlucky may fall by the wayside, the opportunity for well-planned enterprise will remain as great as in the other fields of the mineral industry. Today's problems and uncertainties are the price of admission to the opportunities of tomorrow."

Utah Mining Association Maps Program For Improved Industry-Government Relations

NEW OFFICERS of the Utah Mining Association for the year 1956 were named at annual meeting of the organization, held Dec. 12, 1955 at Salt Lake City.

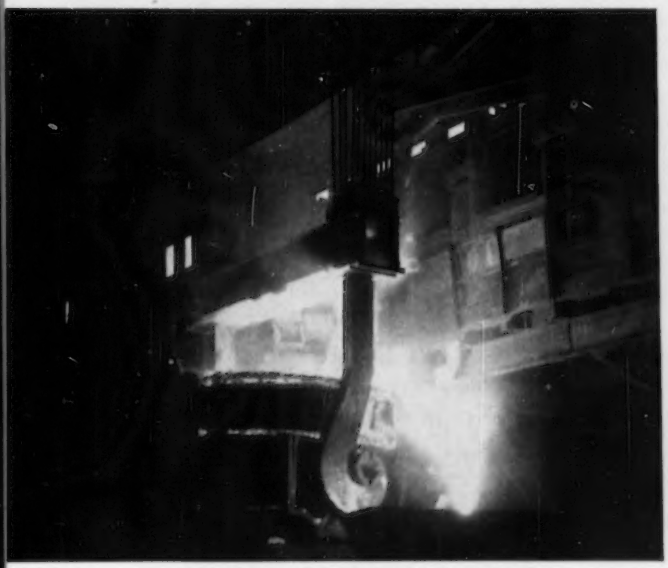
L. F. Pett, general manager of the Utah Copper division, Kennecott Copper Corp., was elected president. Mr. Pett is a former vice president of the organization and succeeds Otto M. Herres, Salt Lake City, vice president of Combined Metals Reduction Co. and chairman of the National Lead and Zinc Committee. He is succeeded as first vice president by Clark L. Wilson, vice president of New Park Mining Co.

Newly named to the executive group of the organization is Charles A. Steen, president of Utex Exploration Co. Inc., who will serve during 1956 as second vice president. A. G. Mackenzie was also elected vice president and consultant.

Miles P. Romney, well-known mining industry spokesman, is secretary-manager of the Utah Mining Association and Walter M. Horne is assistant secretary manager.

In the policy statement of the association it was "strongly" urged that the Federal Government adopt a long-range national mineral policy to govern "its actions on matters within its jurisdiction which affect the domestic mining industry. The need for such a policy is demonstrated by the present uncertainty about future markets and exploration expenditures resulting from the lack of such a policy. Federal Government action on matters affecting the mining industry in the past has been based on expediency," says the statement.

"Plans and pleas for increased production have been frantically issued by departments of the Government in emergencies, but casual indifference to the needs of the industry has predominated



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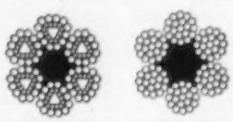

Flattened Strand Round Strand

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L. F. PETT, new president of Utah Mining Association, is general manager of Kennecott Copper Corp.'s Utah Copper division.

CLARK L. WILSON, new first vice president, is with New Park Mining Co.

CHARLES A. STEEN, president of Utex Exploration, is second vice president.

once adequate supplies were again available." In its recommendations, the Utah Mining Association included the following "principles":

(1) Assurance to the domestic mining industry of their fair share of the domestic market; (2) that measures adopted for the relief of the industry be based on the controlling of imports to the level needed to supplement the production of the domestic industry; (3) that measures based on stockpiling and subsidy be avoided in all cases "except when justified to encourage exploration for and mining of" strategic minerals; (4) that future exploration and replacement of reserves now being depleted, are dependent upon reasonable assurance of a future domestic market.

In the field of mineral lands and policy, the statement advocates discouragement of "abusive, non-mining uses of the General Mining Laws . . . in order that full appreciation of the effectiveness of the present system of location and patenting of mineral land might be realized," and cites the need for new provisions to permit holding of prescribed land areas for a reasonable period by those who seek to discover hidden mineral deposits . . . through use of modern methods.

UMA discusses taxation in its general policy statement and asked for a more "moderate" levy on the mining industry to recognize "the need of incentive for making risk investments in mineral exploration."

Among specific incentive provisions suggested were:

(1) Removal of limitations on deductibility of exploration expenses; (2) tax exemption on new mines for three years after beginning of profitable operations; (3) elimination of . . . barriers to private investment, discriminatory taxation on products of mines, and multiple taxation of profits of mining.

Norwegian Ilmenite Find Made by Aeromagnetics

100-MILLION ton ilmenite find of Titania A/S, of Skondal, Norway, was the first announced major discovery of an orebody by aeromagnetic methods in the European area, it is reported.

Aeromagnetic methods have been used successfully for some time in Canada, the U. S. and Latin America, but the Norwegian find is the first on that continent.

Norwegian firm employed Hunting Geophysics Ltd. to survey some 300 square miles of fjord-dotted terrain in southwest Norway. Work began in Summer 1955 by another of the Hunting Aerial Survey Group companies, which took topographic photographs and then the Geophysics organization began flying its survey.

The find, owned by National Lead Co. through its Titania subsidiary, was announced in October.

Pickands, Mather & Co. To Reopen Quebec Iron Mine

PICKANDS, MATHER & CO., Cleveland, has joined with Steel Co. of Canada in a $16-million venture to reopen an iron mine at Bristol, Que., which has been down for the past 85 years. John Sherwin, president of PM&Co., said the plans of the two companies include construction of a $12-million processing plant and construction of three miles of railway to connect the property with the Canadian Pacific Railway.

Sherwin said the new plant, located some 40 miles northwest of Hull, is expected to begin operation in late 1957. Construction will begin early this year.

Some 600,000 tons per year output is planned from the operation, with half to remain in Canada and half to go to Pickands, Mather customers in the U. S. The two firms will share in the cost of the project.

Iron ore reserves at the site are estimated good for 15 to 20 years at the scheduled output. Pickands, Mather, who will operate the facility, will beneficiate the ore and ship 66% Fe concentrate. Operating company, Bristol Quebec Mining Co. Ltd., will be wholly owned by PM in conjunction with Jones & Laughlin Steel Corp.

Japanese Plan Reopening of Nigita Aluminum Plant

JAPAN LIGHT METAL CO., largest aluminum manufacturer in Japan, announced that it hopes to reopen its plant in Niigata, northern Japan, to increase primary aluminum production by about 20,000 tons annually, according to a spokesman of the company. He said the company was not sure whether it could raise the funds, estimated at 5,000-million yen required for rehabilitating the plant, which had been left idle for ten years. Another problem would be to secure electric power supplies for the plant, which had no independent generating facilities.

Under the present plan, the rehabilitation project would be started this year to restore production capacity of 10,000 tons annually by 1958, and another 10,000 tons by 1960, the spokesman said.

Japan's aluminum production last year was expected to total 58,000 tons.

DMEA Exploration Contracts

DURING THE MONTH OF OCTOBER, 17 new contracts were let by Defense Minerals Exploration Administration for assistance in the following states: Arizona and Nevada (tungsten), Colorado (copper-lead-zinc), Georgia, Montana and North Carolina (mica), New Mexico (lead-zinc) and Utah (uranium, lead-zinc).

42 new applications, including one

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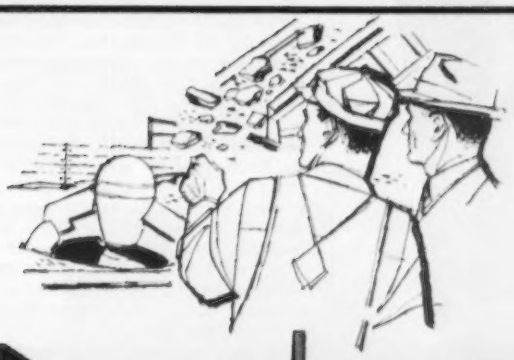

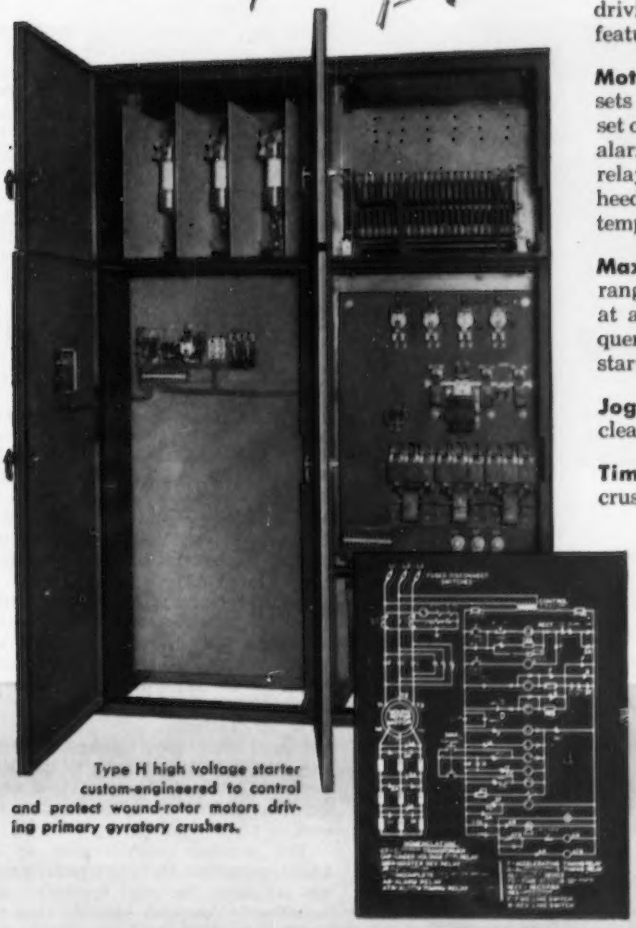

Type H high voltage starter custom-engineered to control and protect wound-rotor motors driving primary gyratory crushers.

Allis-Chalmers has built and installed hundreds of gyratory crushers in the past 75 years. Drawing on this experience, A-C engineers have developed a control circuit designed to cut costly down-time in the rough-tough job of rock and ore crushing. This control circuit is considered by rock products operators to be the ultimate in control and protection for wound-rotor motors driving primary gyratory crushers. Here are some features of this circuit:

Motor Overload Protection — Two separate sets of thermal overload relays are provided. One set operates on slightest overload to sound remote alarm horn and energize indicating light. These relays do not stop motor. If warnings are not heeded, a second set of relays stops motor when temperature reaches danger point.

Maximum Torque Starting — Control is arranged so that maximum torque can be obtained at any time while motor is being started. Frequently, application of maximum torque permits starting a stalled crusher and clearing jam.

Jog-Reversing Controller permits rocking to clear jam.

Time-Delay Undervoltage Relay allows crusher to ride through momentary voltage dips.

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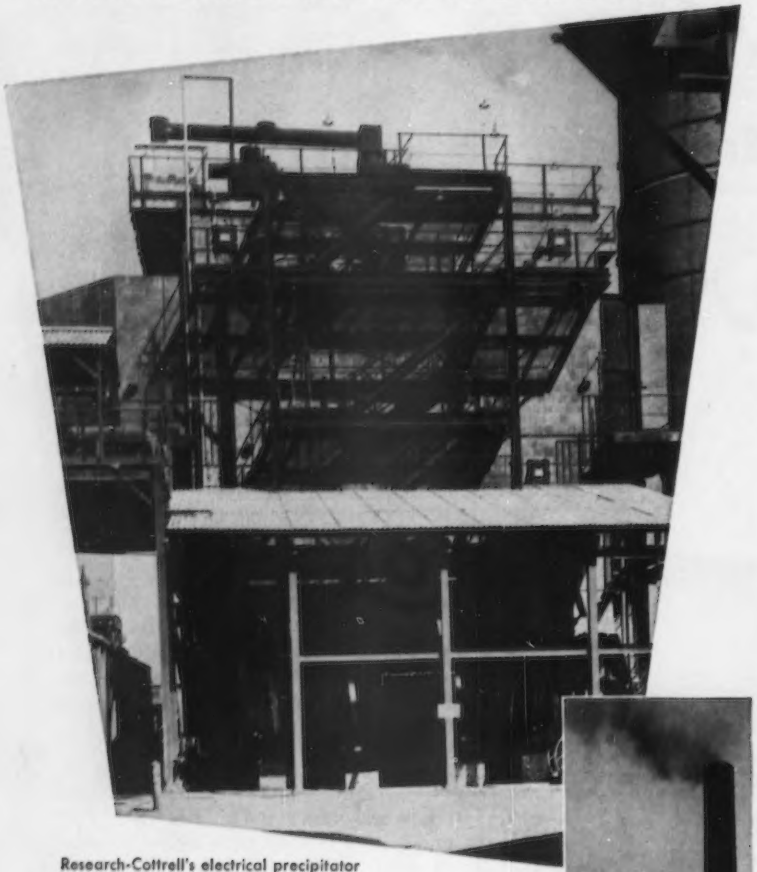
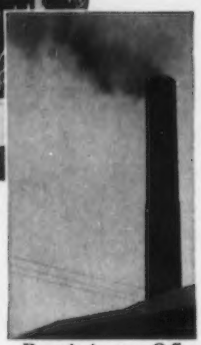
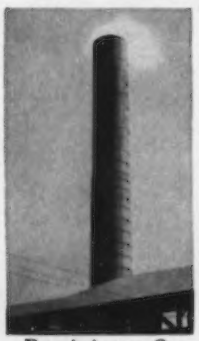


Research-Cottrell's electrical precipitator installation at the Palmerton, Pa. plant.



Precipitator Off



Precipitator On

The two photographs (right) show the results of this Research-Cottrell installation. The smoke in the picture at the top (Precipitator Off) consists of dry dust and fume entrained in the zinc ore sintering machine gases.

The picture at the bottom (Precipitator On) shows nothing but water vapor escaping from the same stack.

If you have a fume problem that involves recovering valuable materials that are going up the stack or combating a smoke nuisance, get in touch with your nearest Research-Cottrell representative. His experience with over 300 roaster and metallurgical precipitators will enable him to advise you on the most effective—and economical solution to your problem.

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DMEA *(Continued)*

for uranium in New Jersey, were received. To date 2,854 applications have been received, all but 197 have been processed. 215 projects have been granted certificates of discovery or development (3 more in October.)

Glidden Co. Is Restoring A Copper Property

APPROXIMATELY $1-million has been spent by the Glidden Co., Cleveland, to investigate copper values at its Bully Hill mine, in the Lake Shasta area of northern California. The firm acquired the property in 1920 when two mines were being operated: the Bully Hill for copper and the Rising Star for zinc.

Bully Hill was closed when copper prices slumped. Rising Star was mined until 1928. In February 1954, Glidden began exploring for ore at the old 870-ft level and found pyritic zones with wide occurrences of chalcopyrite and a virgin ore shoot which extends down to the 970 and up to the 770.

Ira B. Joralemon, San Francisco consultant, has estimated that known and probable values on the 870 level would approximate $1-million. Ore is being stockpiled at the surface. Western Mining Machinery Co. is running flotation tests on the ore and E. J. Longyear has been conducting restoration and exploration work.

Assays of average samples show copper content ranging from 0.54% to 4.58%; zinc from 0.75 to 15.74%; silver from a trace to 6.47 oz; and gold up to 0.44 oz.

American Metal Official Compares Pricing Methods

IN A DISCUSSION of the comparative methods of copper pricing on the London Metal Exchange and the price published in *E&MJ Metal and Mineral Markets,* the following letter was sent to L. H. Tarring, editor of *The Metal Bulletin* of London by Jean Vuillequez, vice president in charge of sales for American Metal Co.

E&MJ Metal and Mineral Markets is a weekly publication of the McGraw-Hill Publishing Co., edited by the Markets Department of E&MJ, which provides prices for the major metals and minerals.

Mr. Vuillequez' letter follows:

Dear Mr. Tarring:

I read with great interest the substance of a talk you gave to the Non-Ferrous Club at the Queen's Hotel which appeared in *The Metal Bulletin* of November 8.

You conclude with respect to the E&MJ quotation that "marginal quantities are fixing the price for major consumption." You also indicate that this is what is done basically "only in a broader way" by the L.M.E.

Your conclusion, which is quite incorrect, appears to be based on a misunderstanding of the statement attached to my letter to you of February 18, 1955. This statement admittedly did not clearly

GM DIESEL
CASE HISTORY No. 556-188

OWNER: Badgett Mine Stripping Corporation, Madisonville, Ky.

INSTALLATION: GM "6-110" Diesel-powered Bucyrus-Erie 3-yard shovel loading fleet of GM Diesel-powered Euclid rear dumps on Pennsylvania Turnpike extension project.

PERFORMANCE: Partner Brown Badgett says GM Diesels are "doing a wonderful job." He's running his shovel 10 hours a day, plans to start 24-hour operation soon.

"Doing a Wonderful Job"

FEW WOULD expect to find a mine-stripping contractor on a road-building job. However, where there's dirt and rock to be moved in a hurry it is *not* unusual to find a General Motors Diesel-powered excavator. The faster, livelier crowd and swing of a "Jimmy" powered shovel means more yards per day at a lower cost per yard.

Principal reason for this snappy action is that a GM 2-cycle Diesel delivers power on *every* piston downstroke—not on every *other* downstroke as in 4-cycle engines. That means faster acceleration, instant response to throttle demands, real "go" when the bucket takes a bite.

And a GM Diesel costs less to maintain, too. Valves cost up to 62% less, cylinder liners cost up to 40% less, than similar parts for other Diesels.

More than 150 different manufacturers pick GM Diesel power for over 850 different models of equipment they build. Your GM Diesel distributor can give you the list plus full information on GM Diesel engines. See him today or write direct.

DETROIT DIESEL

ENGINE DIVISION OF GENERAL MOTORS

America's Largest Builder of Diesel Engines

Single Engines . . . 30 to 300 H. P. Multiple Units . . . Up to 893 H.P.

GM GENERAL MOTORS DIESEL POWER

The tough ones come to **Card**

ANACONDA
solves maintenance by car standardization

Over 15 years ago, the Anaconda Copper Mining Co. came to Card seeking the engineering of a side dump ore car that could serve a wide scattering of mine properties in Montana. Design requirements submitted by Anaconda called for long life in underground heavy-duty haulage and highly corrosive conditions.

About 1200 Card Granby-type cars are now in service in Anaconda's Montana operations. The latest designs differ in minor aspects from the original order, but all have proved highly satisfactory. The 115 cu. ft. car on 36" gauge has a high capacity to length ratio, keeping trains short. For maximum capacity, doors and back are internally braced. To ease loading shocks, the trucks are coil spring mounted, and the use of Card heat treated cast steel wheels with Timken bearings assure extended wheel life and easy haulage. Card engineers are happy to consult on any haulage problem. No obligation.

C.S. Card Iron Works Co.
2501 WEST 16TH AVE.
DENVER, COLORADO

Copper Pricing *(Continued)*

state its purpose—to show generally the price "barometer" followed by large producers. Apparently you assumed that it was a description of how *E&MJ* arrive at their quotations.

The fact is that most of the large U. S. producers, including Anaconda, Kennecott and Phelps Dodge, sell the greater part of their production at fixed prices. Each producer announces his individual price. Some of them sell at their price effective on date of shipment of the copper. With the notable exception of the Anglo-American group, the practice of selling at fixed prices is general for all large copper producers of the world. Such fixed price sales are reported to *E&MJ* on a daily basis every Wednesday by the following companies:

American Metal Company for itself and its clients (including RST).

American Smelting and Refining Company.

Anaconda, including Chile.

British Metal Corporation (Canada) and C. Tennant, Sons, for their Canadian and the Anglo-American groups.

Calumet & Hecla.

Consolidated Coppermines.

International Minerals & Metals, including Magma and San Manuel.

Katanga (by cable from Brussels).

Kennecott, including Chile.

Adolph Lewisohn, including Miami and Tennessee.

Phelps Dodge.

Sales of U.S. mined copper and scrap establish the domestic *E&MJ* quotation. Sales of foreign copper, including copper smelter or refined in the U.S. from raw materials of foreign origin, produce the foreign *E&MJ* quotation.

As you will see from the above list of companies *E&MJ*'s coverage includes all the large mine producers in Africa and the Americas. They account for approximately 90% of the mine production of the world, exclusive of the Iron Curtain and China. Production of the U.S. custom smelting industry, which is sold practically entirely at fixed prices, is also included in arriving at *E&MJ*'s quotations.

Fixed price sales reported to *E&MJ* for the week ending each Wednesday during last September and October and L.M.E. turnover for the same weeks, in short tons, I understand were approximately as follows:

	For the Domestic E&MJ Quotation	For the Foreign E&MJ Quotation	Total	L.M.E.
Sept. 7	19,688	21,549	41,237	3,724
" 14	21,183	13,210	34,393	5,572
" 21	21,932	11,169	33,101	4,536
" 28	23,821	9,974	33,795	3,248
Oct. 5	25,373	10,375	35,748	6,272
" 12	16,832	11,779	28,611	8,680
" 19	26,233	12,700	38,933	6,132
" 26	20,696	13,184	33,880	4,760
Total	175,758	103,940	279,698	42,924

It will be seen that total fixed price sales reported to *E&MJ* during the above period were seven times greater than the total L.M.E. turnover. Most of the fixed

NEWEST PAYLOADER® MODEL sets the pace for a bomber base

Here is the starting point of Peter Kiewit Sons "production line" for concrete placing at a large bomber base — a Hough model HH "PAYLOADER" tractor-shovel feeding a belt conveyor with sand and gravel from adjoining stockpiles. The task of the "PAYLOADER" is a crucial one, because failure at this point would bring the entire concrete-placing operation to a standstill.

Peter Kiewit Sons, one of the largest and most progressive of heavy contractors, have been using "PAYLOADER" tractor-shovels for years on their contracts all over the United States. You too, can depend on the proven performance of "PAYLOADER" tractor-shovels and on the large and reliable Distributor organization that sells and services them, both at home and abroad.

This model HH is one of three completely-new 4-wheel-drive "PAYLOADER" tractor-shovels. They all have a sensational new kind of bucket arm design that provides 40 degrees of bucket tip-back at ground level, powerful pry-out action plus unusual safety, stability and visibility factors.

PAYLOADER®
MANUFACTURED BY
THE FRANK G. HOUGH CO. LIBERTYVILLE, ILL.
SUBSIDIARY—INTERNATIONAL HARVESTER COMPANY

THE FRANK G. HOUGH CO.
726 Sunnyside Ave., Libertyville, Ill.

Send data on new 4-wheel drive units

- ☐ Model HU—1 cu. yd.
- ☐ Model HH—1½ cu. yd.
- ☐ Model HO—2 cu. yd.
- ☐ Smaller "PAYLOADER" units

Name_____
Title_____
Company_____
Street_____
City_____
State_____

Copper Prices *(Continued)*

price sales reported to *E&MJ*, my guess would be about 90 percent or say 250,000 tons of the above total, are for prompt delivery. Of the L.M.E. turnover of 42,924 tons shown above, only 6,496 tons were for spot delivery; the remainder was for forward dates. The ratio of prompt transactions was therefore some 40 *E&MJ* to 1 L.M.E.

The "official" first call is the price which governs for practically all contracts on the basis of L.M.E. quotations. Hence it can be maintained, at least for the purpose of comparison with *E&MJ*, that the second call turnover should be excluded. Such exclusion would reduce the above L.M.E. turnover to 28,672 tons of which 4,984 tons for spot delivery. Furthermore the L.M.E. turnover includes substantial quantities of jobbing, carries, and of what I believe the trade considers "window dressing." The comparison would be even more lopsidedly in favor of *E&MJ* if L.M.E.'s turnover were reduced to the common denominator of fixed price outright sales.

From the above facts I think it is clear that the *E&MJ* quotations are realistic and established by the overwhelming bulk of the free world's refined production.

Sincerely,
(Signed) J. Vuillequez

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BUT NOBODY
BUT . . .
SPANG
makes a completely
weldless
alloy-steel
jar
drills up to 4 times more footage-with fewer fishing jobs
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DEPT. M-2 • BUTLER, PENNSYLVANIA
For over 60 years Manufacturers of Spang Weldless Jars and a Complete Line of Cable System Drilling and Fishing Tools for Oil and Gas Wells, Prospect Drilling and Shot Blast Holes.

IN THE U. S.

ALASKA

Climax Molybdenum Co.'s. drilling program on the Ross-Adams radioactive property, Prince of Wales Island, has been halted for the winter. Present plans are for resumption of the drilling next spring, and possible construction of a tractor trail to the property.

Kenai Chrome Co. closed down operations at Red Mountain for the winter Nov. 1. They could not start until July 1, 1955 because of bad weather and snow conditions, but they report truck deliveries from the mine to the beach averaged 600 tons per week for the season, and hope to produce 7,000 tons this year. They employ a crew of about 25 men when operating.

At last report, Moneta Porcupine Mines, Ltd., were still doing development work at the Red Top mercury property near Dillingham.

ARIZONA

Western-Knapp Engineering Co., a division of Western Machinery Co., of San Francisco, has been awarded a $5-million contract for complete rehabilitation of the concentrating plant for Inspiration Consolidated Copper Co. at Inspiration.

Construction on the plant is scheduled for completion before the end of 1956.

New concentrator will consist of seven ball mills and will have a total capacity of 16,000 tpd ore. It will increase Inspiration's copper production and create positions for about 80 new employees.

Completion of the concentrator will permit Inspiration to use the dual process for recovering copper from the ores taken from its open pit operations. This process will permit recovery of substantial amounts of copper from sulphide ores which could not otherwise be recovered.

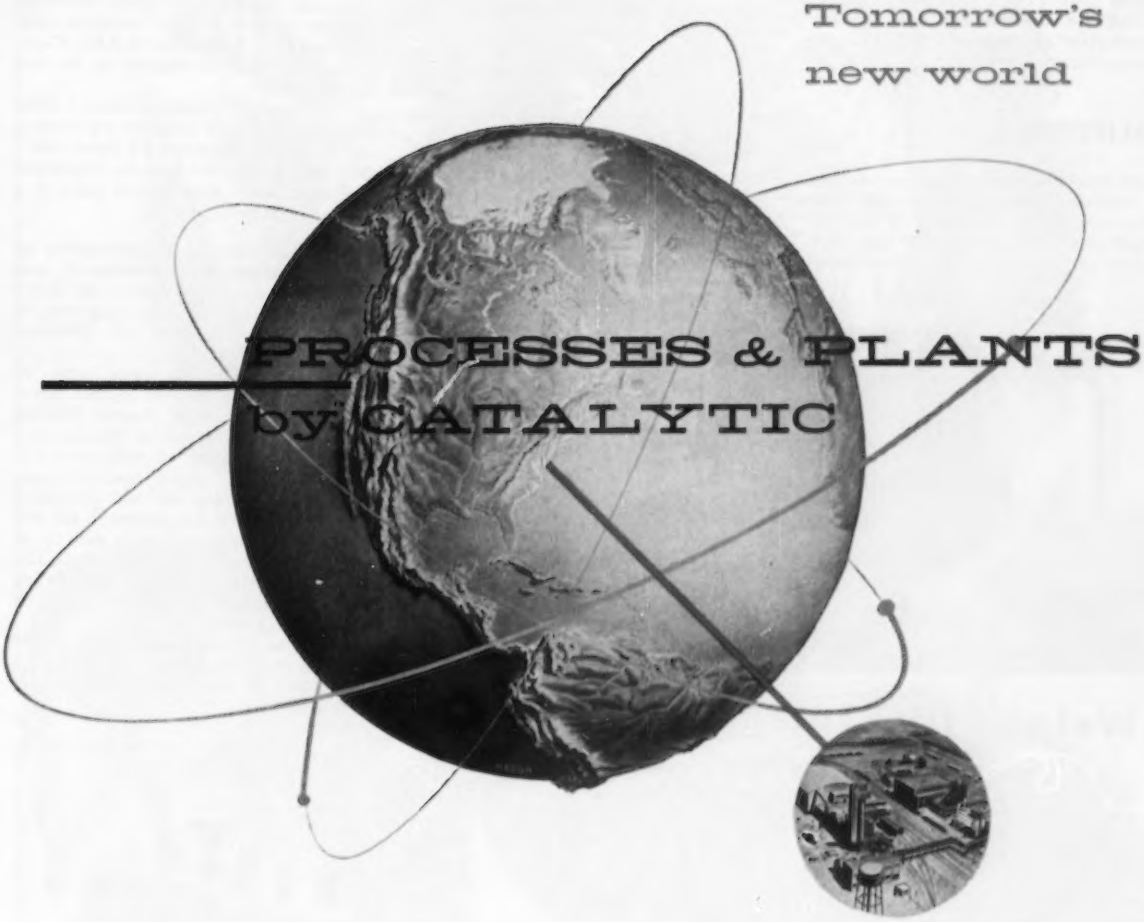
The old Pittsburgh mine, part of the Warsaw group near Ruby in southern Arizona, has been re-opened for recovery of copper, lead and zinc. Ore is sent to Hayden for smelting. The mine has a history dating back to 1870 when it was operated by early settlers and Indians. It also was operated briefly during World War II. Present high price and demand for copper makes working feasible.

Stripping has started at the Pima open pit copper mine southwest of Tucson. Utah Construction Co., which owns the Pima Mining Co., with the Union Oil Co. and Cyprus Mines Co., is handling stripping.

Removal of the overburden is expected to take a year. When finished, there will be a hole nearly ½-mile long and 200 ft deep. Mining and milling production is scheduled to begin at 3,000 tpd.

Condor Mineral Exploration Co. has been formed by Donald Cohn, Fred

Toward
Tomorrow's
new world



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Arizona *(Continued)*

Racette and Vincent Pokrak (all from Illinois) for the purpose of exploiting copper-silver and uranium claims on the Papago Indian Reservation.

CALIFORNIA

Idaho Maryland Mines Corp. has received an additional Federal loan of $39,800 for developing the extension of the 900 tungsten ore shoot on the 700 and 1100 ft levels of its Grass Valley mine, according to president Bert C. Austin.

Company, once a leading gold producer of the Mother Lode, previously was granted a $28,000 loan for development of the mine.

Austin said the company is shipping about 250 tons of ore a week with values running $50-$60 per ton. The ore shoot on the 900 level has been developed for a length of over 400 ft.

With the company's new five-ton-per-hour tungsten mill at Grass Valley in operation about Jan. 1, Austin anticipated savings up to $15 per ton in transportation and milling costs. Ore now is shipped to Lovelock, Nev., for processing.

LEFT: Weighing a car in motion at Seven Islands. BELOW: Typical control and printing units at Seaboard's Hamlet yard.

Weighs 100 cars in 20 minutes "on the fly"

All iron ore from the new Labrador fields—over 6 million tons in 1955—is weighed in motion by these Cox & Stevens electronic track scales. Installed by Iron Ore Company of Canada at Seven Islands, the scales automatically print-weigh a train of 100 cars in just 20 minutes!

After extensive experience, the Company reports: "Fast motion weighing . . . approximately twice as fast . . . accuracy equal to the best . . . maintained over longer periods . . . maintenance costs are low."

Many other modern railroad classification yards are now speeding all types of freight to destination . . . thus making available more cars . . . with accurate electronic motion weighing. The "Electro-Load" scales can be linked with machine tabulating, teletype or other automatic systems, saving time and paper work and preventing human error.

See what Cox & Stevens electronic track scales can do to reduce weighing costs, speed up delivery, and increase customer service.

COX & STEVENS ELECTRONIC SCALES DIV.

Revere CORPORATION OF AMERICA 14

WALLINGFORD, CONNECTICUT A Subsidiary of Neptune Meter Company

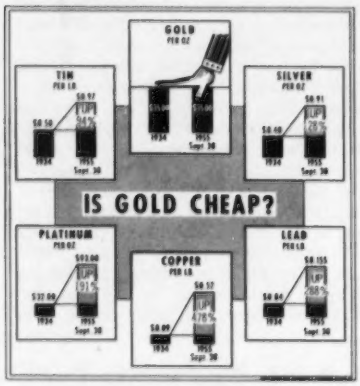
Verdi Development Co. has started commercial production in its uranium mill at Mt. Soledad, in the Mojave area. The chemical precipitation plant produces sodium uranite, of 70% uranium concentrate, for shipment to the AEC. Capacity of the mill is expected to be well above 100 tpd.

Verdi has 1,000 acres of leases 7 miles from the mill, with sufficient ore blocked out to "justify operation for some time." MacAfee & Co., Los Angeles, engineered the plant, which incorporated parts of a former gold mill.

New Jersey Zinc Co. is investigating by diamond drilling the possibility of open pit mining on a major scale at the Royal and Mountain King gold properties in the Copperopolis area of Calaveras County.

New Jersey Zinc has leased some 500 acres comprising the two famous mines from Stewart & Nuss, Fresno. Drilling was carried on September through November, and analysis of drill cores will determine further exploration. It is estimated that between 40- and 50-million tons of shovel ore are present in the two mines, which produced many millions in gold during the gold rush period. The Royal was operated as late as 1942, when War Production Board Order L-208 stopped production.

Calaveras mining engineers who have seen the diamond drills are optimistic for resumption of large scale gold mining at the mines.



New Idria Mining and Chemical Co. reports its new acquisitions are now making substantial profits. C. Hyde Lewis, president, says good progress has been made in development of Strawberry tungsten mine since operations were started in May. Output, as well as grade of ore, has been increasing so that profits before depletion, depreciation and taxes are running about $3,000 daily. Although operating results for October and November were expected to increase sharply, heavy snowfalls in the high Sierras of California will force closing down the mine for about five months.

Intensive development at the New Idria quicksilver mine has produced additional ore, Lewis says. He reported the company may apply for a third DMEA loan to open up the Sulphur Springs area of the property.

Operations at New Idria's uranium

Coppus VENTAIR (centrifugal type)

Coppus VANO (propeller type)

Choose between them and get 30% to 100% more air

Coppus Blowers are designed for two different types of mine ventilation requirements: the centrifugal Coppus VENTAIR is for long pipe lines; the propeller-type Coppus VANO for shorter lines . . . the correct selection will give you from ½ more to twice as much air — for a given power consumption — than an ordinary all-purpose fan.

Available for either compressed air or electric motor drive, both can be used as blowers or exhausters and are obtainable in capacities up to 90,000 CFM.

Only Coppus makes both these types, one of which will give you better, more economical mine ventilation . . . know them by the "Blue Ribbon" that symbolizes the engineering and production skill behind every Coppus product.

Representatives listed in MINING CATALOGS. Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers and exhausters for special purposes. See also THOMAS' REGISTER . . . Coppus Engineering Corporation, Worcester 2, Mass.

COPPUS ENGINEERING CORPORATION
281 Park Avenue, Worcester 2, Mass.

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California *(Continued)*

property on Beaver Mesa in Colorado are "progressing satisfactorily." The tunnel to the rich Hubbard claim will be completed by the end of 1955.

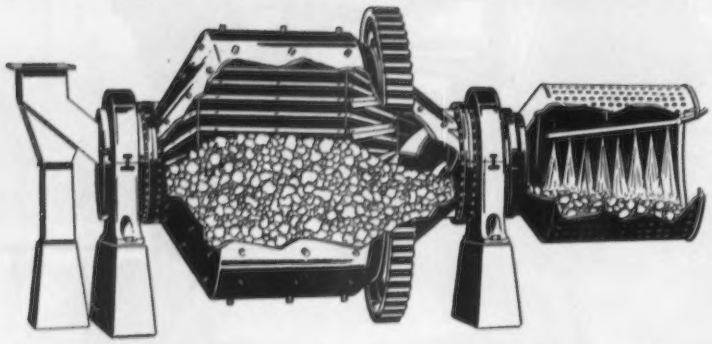
Greatly enlarged mining operations are planned at the Guadalupe Mine property near Los Gatos by the Palo Alto Mining Corp., which has taken over the lease from W. L. Mackinnon. Mackinnon, who gave up his interests in the mine because of ill health, has operated the mine on a small scale for the last three or four years.

The Guadalupe property, which totals about 1,800 acres, is considered to be one of the richest mercury-bearing mines in the state.

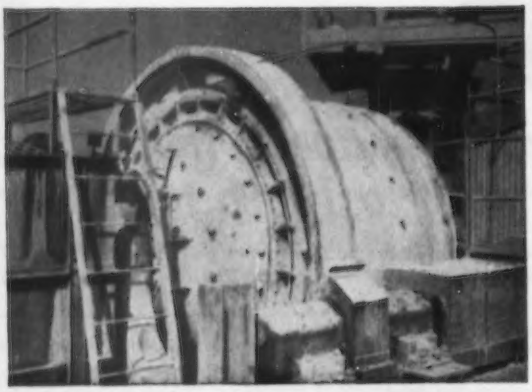
The group leasing the Union or No. 1 mine from Surcease Mining Co. at Atolia, San Bernardino County, hit a good-looking streak of ore while cross cutting for the 4 level of the Amity mine from 210 ft.

Partners in the group—Red Tramill, Clyde Hewitt, John Turner, Ted Boring and Jim Pankey—have been leasing from Surcease for the past nine years. They recently took in Leon Lasky as a member of their mining group.

HARDINGE SCRUBBERS FOR PIT-RUN MATERIALS



Large diameter, short length trunnions permit chute feeding of unsized ore and rock at rates up to 600 tons per hour.
The mass loading and ball-mill action in the scrubber quickly and completely slurries the clay and dirt, permitting ready separation on washing screens or trommels.



View of a 10′ x 66″ Hardinge Scrubber cleaning crushed dolomite in a California plant.

Bulletin 37-A-1

HARDINGE
COMPANY, INCORPORATED

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Feral Johnson group, Fresno, Fresno County, has applied to the AEC's exploration office in Bakersfield for permission to make a shipment of uranium ore from claims in the North Huntington Lake sector of Fresno County. Feral Dean Johnson, Fresno, heads the group, which has been stockpiling ore for a period of weeks. Occurrence is in Pleistocene sands and gravels along the edge of a stream—a different type than had been identified previously in California.

COLORADO

Three companies remained in competition in early December for the contract to take over operation of the eight Government ore-buying stations and the assay laboratory at the AEC's Grand Junction Operations Office.

American Smelting and Refining Co.'s contract expired Dec. 31.

The three companies still under consideration early in December were United Sampling Service of Grand Junction, Ledoux and Co. of Teaneck, N. J., and Lucius Pitkin, Inc., of New York City.

Glen Boyd and Vance Haynes, both 27 and both seniors at Colorado School of Mines, revealed late in November they have found pitchblende assaying up to 0.53% U_3O_8 on a claim 28 miles southeast of Golden.

The two students said they made their strike last April after weeks of prospecting, and now have leased 280 acres and hold an option on 2,000 more. They are applying for a DMEA loan, and hope to develop the claim themselves.

Organization of Front Range uranium operators into a formal association is being urged by Charles Melbye and Stuart Merwin, consultant geologists of Golden. Primary objective of the association would be construction of a mill on the Front Range to handle ores that cannot be profitably developed because of high transportation costs.

American Leduc Uranium Corp. reported to stockholders in November that shipments for that month from the company's six producing mines in Colorado and Utah were expected to total 3,000 tons. The company reports two early shipments from its Henderson shaft on Outlaw Mesa, which began production in October, averaged 1.46% uranium oxide and 3.63% vanadium.

Skidmore Mining Co. offices have been moved from Dove Creek to Dolores, and the company may build a new office building and theatre there.

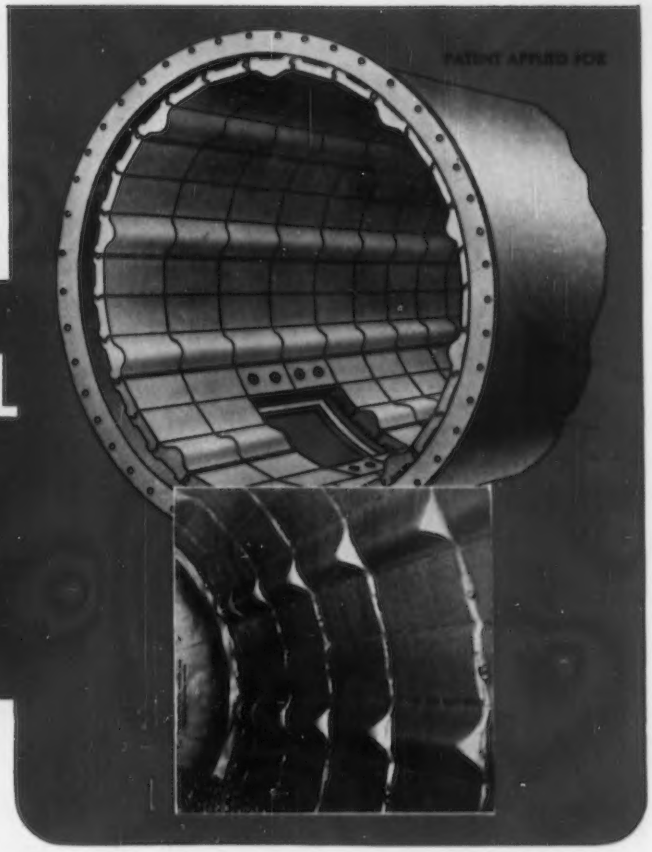
Colonial Uranium has acquired all outstanding shares of U. S. Titanium Corp., Ores, Inc., and extensive oil, coal and lode mining properties, president Robert I. Ludwig, announced. Properties acquired with control of U. S. Titanium include 2,000 acres of titanium property in Albany County, Wyo., and thru Ores, Inc., 38 lode mining claims in Saguache County, Colo.

Silver receipts at the Denver mint in September were off more than 50% over

New

B&W UNIVERSAL LINER PLATES

Raise Performance, Lower Costs



The new B&W Tube Mill Liners have advantages that mean reduced costs in capital, time and labor.

Cost per ton of material ground is reduced, for the practical reasons listed below. Check them—you may find that one, or a combination, of these qualities will solve your existing problems.

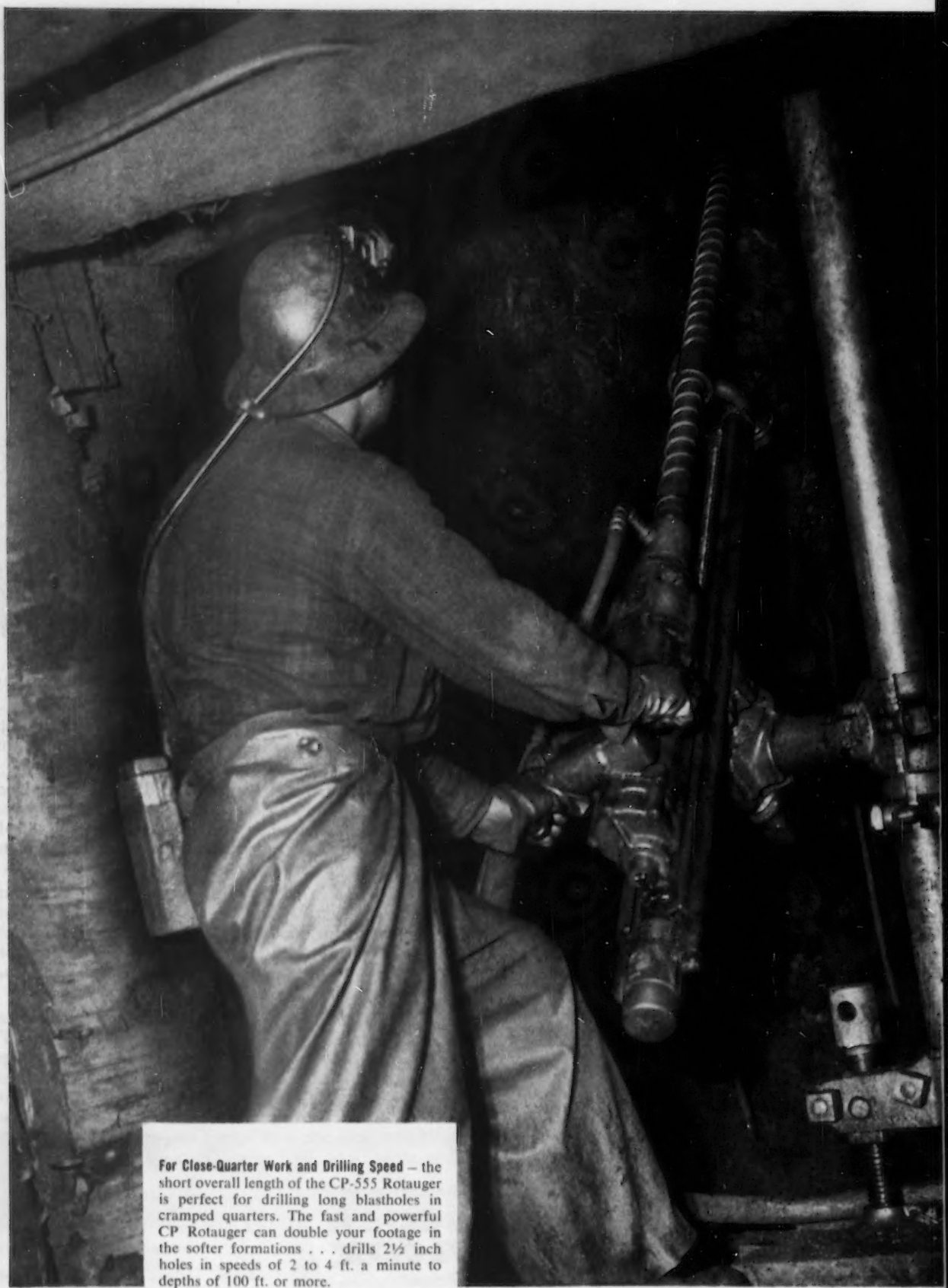
- Lower Initial Costs—No pattern and chiller costs —the result of standardization.
- Longer life of liners—Uniform wear will result from better quality control on a mass production casting, utilizing permanent molds. Size is ideal for uniform chill and heat-treatment.
- Longer life for different applications can be realized by a selection of proper materials. This design lends itself to either chilled irons or wear steels.
- Direct labor cost and the "down-time" to install the liners are reduced. Castings are easily handled due to small size and weight. Less fatigue of workers. No cranes needed to handle lightweight liner castings.
- Cost reduced for storage space. Minimum storage space required as small castings "stack" easily. Records simplified with one design of casting interchangeable for all size mills.
- Saves money on liner inventory. One design fits all sizes of mills, permitting standardization. Quicker unloading and storage possible.
- Savings in breakage claims and delays for replacements. Hard brittle irons are frequently broken in shipment when large castings are used. Small castings are rugged and almost impossible to break by handling.
- Savings in determining most efficient wear pattern. Same castings will produce wear profiles consisting of all lifter ribs, all flats or combination of both, including straight or spiralled lifter ribs. Straight or staggered circumferential joints can be used.

Liners are supplied in two nominal thicknesses, 1½" and 3" with 1½" high lifters. Castings are 6" wide x 12" long. Positive seating of small castings on mill shell means less breakage of castings under operating conditions. For additional information on B&W Universal Tube Mill Liner Plates, write The Babcock & Wilcox Company, Process Equipment Dept., Barberton, Ohio.

BABCOCK & WILCOX

BOILER DIVISION

5-448



For Close-Quarter Work and Drilling Speed – the short overall length of the CP-555 Rotauger is perfect for drilling long blastholes in cramped quarters. The fast and powerful CP Rotauger can double your footage in the softer formations . . . drills 2½ inch holes in speeds of 2 to 4 ft. a minute to depths of 100 ft. or more.

There's a CP drill for every mining need!

For Complete Versatility – CP Integral and Attachable Air-legs teamed up with Chicago Pneumatic Sinkers get the most out of tungsten-carbide bits. The Attachable type is ideal for mounting standard sinkers for intermittent or production drilling; the Integral type is designed primarily for production drilling . . . both models in standard feeds of 36" and 48".

For Blast Hole and Exploratory Drilling – the powerful, lightweight, easy-to-handle CP-55 Diamond Core Drill is faster than any other diamond drill in its class. Has a highly efficient CP Rotary Air Motor . . . requires a minimum of air per foot drilled. Conservatively rated at 500 feet with E Rods and EX Fittings. Skid mounted types are available for test borings . . . rated in capacities to 2250 ft.

For Stoping and Raising – the CP-34 Stoper has just-the-right combination of piston speed, foot-pound blow, rotating speed and feed-leg pressure to achieve that extra long service and performance from tungsten-carbide bits.

Chicago Pneumatic *8 East 44th Street, New York 17, N. Y.*

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Colorado *(Continued)*

the like period of 1954 and gold showed a slight decline, mint officials report. Most of the drop in silver receipts is attributed to recent labor strikes in the copper mines of large producers of by-product silver and gold. Receipts of silver were down to 254,741 oz worth $230,543 from 701,291 in 1954 worth $634,616. Gold receipts stood at 55,204 oz worth $1,932,173, a drop from the 74,382 oz worth $2,603,392 in September 1954.

Globe Hill Mining Co., Colorado Springs, is continuing work on its 23-claim lease in San Miguel County. No. 2 tunnel has reached a length of 165 ft. Ore of shipping grade was encountered at about 70 ft from the portal and extended 40 ft along the tunnel. One shipment of 28.4 dry tons has been made assaying 1.97% V_2O_5 and 0.22% U_3O_8. It is valued at $45.51 a ton, including all bonuses other than hauling allowance. Total value of the shipment was $1,292.48.

Cons. Gold and Uranium Corp. will begin extending its 1100-ft Treasure Key tunnel according to W. R. Plankinton, president. Tunnel portal is situated about 1¼ miles south of Blackhawk on the west side of Clear Creek. The tunnel, Mr. Plankinton says, will be extended another 6,000 ft to intersect at least another 50 well known and well defined ore veins.

A fairly large ore body of good grade has been discovered on the 23rd and bottom level of the Cresson mine at Cripple Creek, it was reported by Alfred Bebee Jr., superintendent. The body has now been drifted on for a distance of 50 feet both ways from the original discovery. Bebee said some of the ore was fairly low grade but that some of the rounds grab-sampled better than $70 a ton in gold. Development work is continuing.

Three Forks Oil & Uranium Co. is going ahead with plans for the construction of a mill in Steamboat Springs, and company officials say they are confident AEC terms can be met and a go ahead signal obtained. D. L. Radcliffe, a mining engineer who helped build the Anaconda mill at Bluewater, has been added to the Three Forks staff and is in Steamboat now to start preliminary construction plans. Three Forks is engaged now in an extensive drilling operation at the holdings near Columbine.

Engineers for the Burke-Martin Mines of Montezuma, according to president Tom Martin, estimate that orebodies now fully developed in the property are sufficient to supply a mill with a 50 tpd capacity for a year. According to Martin this entire body of ore has been tested and the values in gold, silver, lead and zinc average for all the ore $68.70 a ton. The Burke-Martin mill is now under construction and company officials expect it to be operating soon.

Reynolds Uranium Corp. with offices in Denver, operating the old Joe Reynolds properties on Silver Mountain near Lawson, in Clear Creek County, reports that it has just opened a body of silver-lead-zinc ore in its No. 3 vein where it was cut by a northerly crosscut from the Elida Tunnel. Drifting to the west on this ore is now in progress, two shifts of miners working. Some 200 ft to the west of where these miners are working is a body of ore which was disclosed some time ago by core-drilling from the Elida Tunnel.

One of the largest mining claim filings made in recent years was entered at Clear Creek County Clerk's office recently at Georgetown. G. W. Gabriel of Morrison entered location certificates and a map in lieu of opening discovery shafts, for 40 claims straddling Dry Gulch near the eastern foot of Loveland Pass. Thirty-two other claims were located by the Pamela Company above the Gabriel claims extending over the shoulder of Mt. Parnassus into the Bard Creek drainage. The address of the company is Littleton. The claims are in the Queens mining district.

Uranium prospecting was further stimulated in the Gardner Basin District of Huerfano County, when New Jersey Oil & Uranium Exploration Co. samples of sedimentary tertiary wash, taken from their pits approximately two miles north

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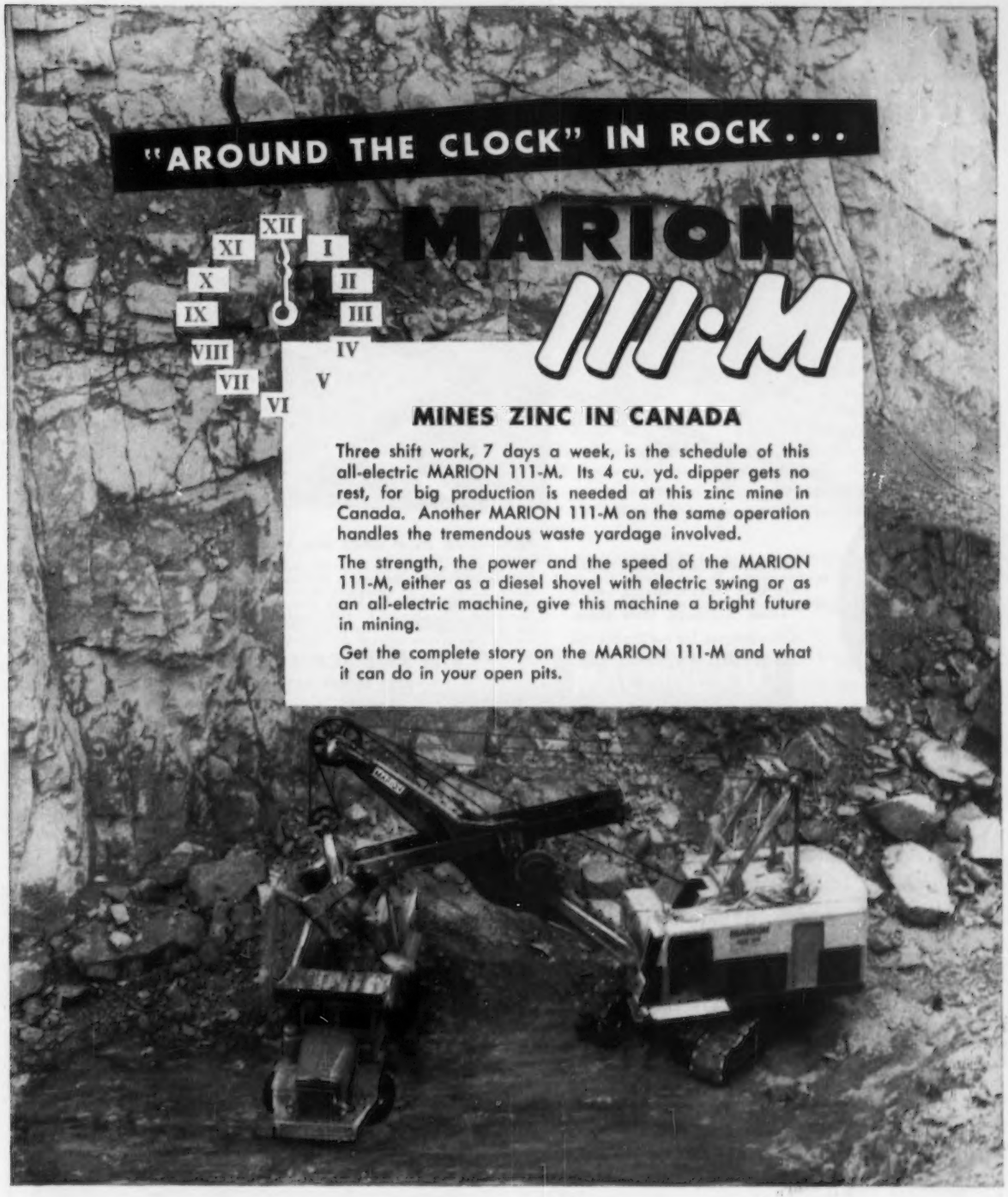
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MARION
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XI
MINES ZINC IN CANADA
Three shift work, 7 days a week, is the schedule of this all-electric MARION 111-M. Its 4 cu. yd. dipper gets no rest, for big production is needed at this zinc mine in Canada. Another MARION 111-M on the same operation handles the tremendous waste yardage involved.
The strength, the power and the speed of the MARION 111-M, either as a diesel shovel with electric swing or as an all-electric machine, give this machine a bright future in mining.
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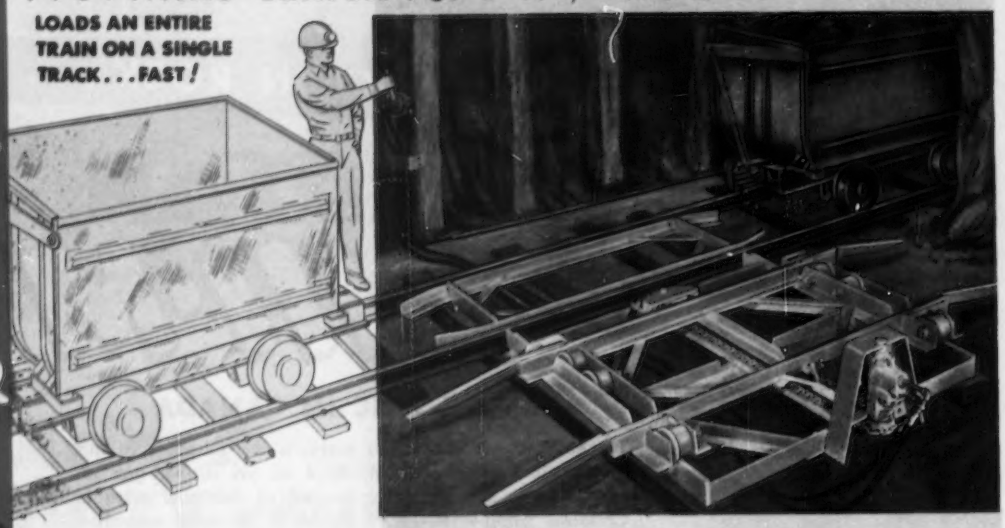
LOADS AN ENTIRE TRAIN ON A SINGLE TRACK...FAST!



Now—one man does the work of three.

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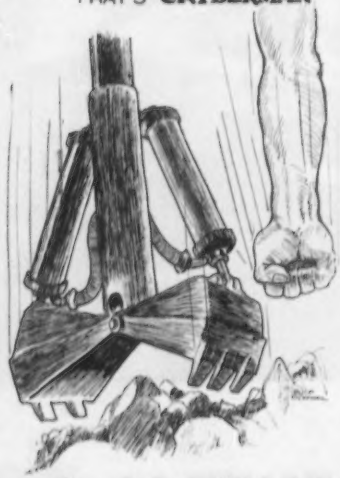
HUMAN ARM ACTION WITH PLENTY OF PUNCH THAT'S CRYDERMAN

NEWLY PATENTED CANADIAN DEVELOPMENT



Plenty of punch going into the muck pile means a full clam bucket load. The crowding action of the telescopic boom is accomplished by an air cylinder, eliminating the need of gravity to fill the clam bucket. This gives you the desired punch that makes mucking positive.

Air cylinders handle movement of the boom in any direction, giving operator full control at all times. This positive control makes it possible to reach out like a human arm to any part of the muck pile and handle rock of any size. Big muck piles on station cutouts are made easy by the "arm reach" of telescopic boom and air-controlled clam.

Miners like this positive action of the Cryderman Mucker because they know what a good job it does in handling either average or rough muck, and how easily it reaches to the shaft corners in cleaning bottom. Yes—they like it because it makes the job of mucking easier and faster.

The positive controlled Cryderman Shaft Mucker has indeed revolutionized the job of shaft mucking whether the shaft be vertical or inclined. So, when considering your next shaft job be sure to investigate all the advantages offered you by Cryderman.

The Cryderman gets down to the muck pile as quickly as you lower a shaft bucket and is likewise hoisted as quickly. No delay at the start or the finish of the mucking operation.

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Colorado *(Continued)*

of the Security Mines, tested 1.32% uranium oxide, and further announced that stripping operations would commence at once.

IDAHO

Highland-Surprise Consolidated Mining Co.'s new exploration crosscut at its Deer Trail property in the Stanley Basin of Custer County, has encountered the second major vein structure on the property and a drift is now in progress along the northwest strike of the vein, according to Tibor Klobusicky, superintendent. Vein, a replacement in limestone, is wider than drift width and the heading is being kept along the footwall zone where the ore mineralization is best. The hanging wall is to be probed later by drilling. Ore was found in place, as projected from surface exposures.

Development of the big zinc vein, which lies about 170 ft. west of the structure just opened and was intersected by the crosscut last September, is continuing under the $59,750 DMEA contract which has been approved for the project.

Sunshine Mining Co. is financing the current work under a profit-sharing agreement with Highland-Surprise.

Goldstone Mining Co. has concluded an agreement with Tungsten Mountain Mining Co. of Nevada under which the latter firm will finance further exploration and development at the Goldstone property in Lemhi County, in return for an option on Goldstone's treasury shares. Tungsten Mountain has agreed to loan Goldstone $25,000 to finance a raise from the new lower adit to upper workings which yielded substantial gold production to former operators.

Salmon River Scheelite Corp. has encountered tungsten ore of good commercial grade in the new crosscut at its Thompson Creek property in Custer County, superintendent Jim Clutis reports. Drift development of the vein has been started and will be continued throughout the winter months, under a Defense Minerals Exploration contract.

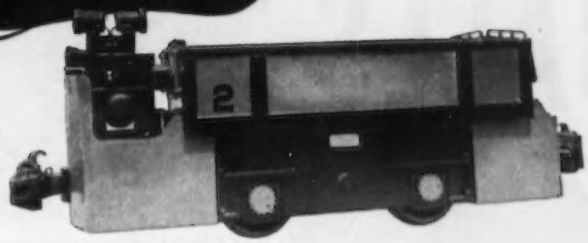
Idaho Custer Mines Inc., of Wallace, is offering 600,000 shares of non-assessable Common stock to provide funds for completion of a DMEA project at its Livingston property in Custer County. Completion of the drilling phase of the project has indicated that geological conditions are favorable to continued ore deposition to depths not yet attained. Balance of the project consists of the sinking of an inclined shaft and further exploration at a lower horizon.

MINNESOTA

Cold weather came early in 1955, closing washing plants soon after the middle of October. Sub-zero weather during the latter part of November necessitated an earlier ending of all ore shipping than

GREENSBURG EIGHT TON MONITOR
Storage Battery Locomotives

...for top performance "Double Equalizers" make the difference



The Greensburg 8 ton Monitor is equipped with two glass insulated motors, contactor type controller and double equalizers. These double equalizers make the difference in performance . . . more tractive effort, better brakes, better riding qualities and longer battery life than any other storage battery locomotive of equal weight and battery capacity!

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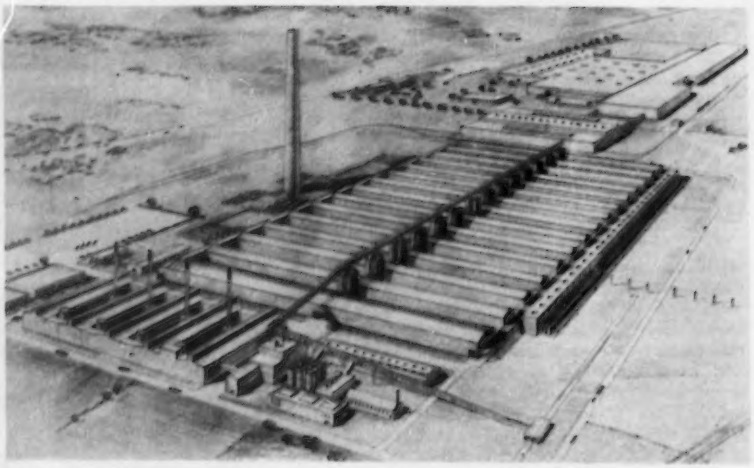


ALUMINUM reduction plant at Ravenswood, W. Va. will follow construction start in April 1956 by Kaiser. Sheet and foil rolling mill (background) is already under construction, will cost some $96-million. An alumina plant is also planned.

Kaiser Aluminum Expands Capacity by 50%

TOTAL ALUMINUM CAPACITY of some 654,000 tons per year is the target of Kaiser Aluminum & Chemical Corp., as announced by D. A. Rhoades, vice president and general manager. The firm plans a $280-million expansion program involving construction of a 220,000-ton aluminum reduction plant at Ravenswood, W. Va. (cost $120-million), and a 500,000 ton alumina plant on the Mississippi River near Gramercy, La., to cost some $60-million. $100-million is also provided for chemical and milling facilities.

"This expansion will increase Kaiser Aluminum's basic capacity by more than 50% and establish the company as the nation's second largest producer," said Rhoades. He noted that the expansion was based on a company survey which indicated that usage will reach 8-billion lb by 1965.

Capacity at the alumina plant will be capable of being quadrupled, according to plans. Plant will consume "Caribbean-type" bauxite, brought in by ship.

Minnesota *(Continued)*

had been expected. Ore froze in railroad cars and steaming was required when cars were unloaded at the docks. This delayed ore boats, sometimes as much as three or four days.

The Duluth, Missabe, and Iron Range docks at Duluth and Two Harbors and the Northern Pacific dock at Superior, Wis., shut down Nov. 26. The freighter W. J. Olcott took the last cargo of ore from Two Harbors. The Great Northern docks at Allouex, Wis., ended their season Dec. 2 with M. A. Hanna Co. mines furnishing the last ore. Grain shipments are expected to continue for another week.

In spite of the unfavorabe fall the early estimate of an 85-million ton maximum tonnage for the Lake Superior area was exceeded. When the final figures are in they should be near or above 87-million tons. About 89-million tons was forwarded in 1951; the record year being 1953 with 96-million tons.

Reports indicate that iron ore prices for the 1956 season will carry an increase of from 50¢ to $1.00 per ton. With one of the iron ore market's largest tonnage grades now priced at $10.10 per ton, the increase could amount to as much as 10%.

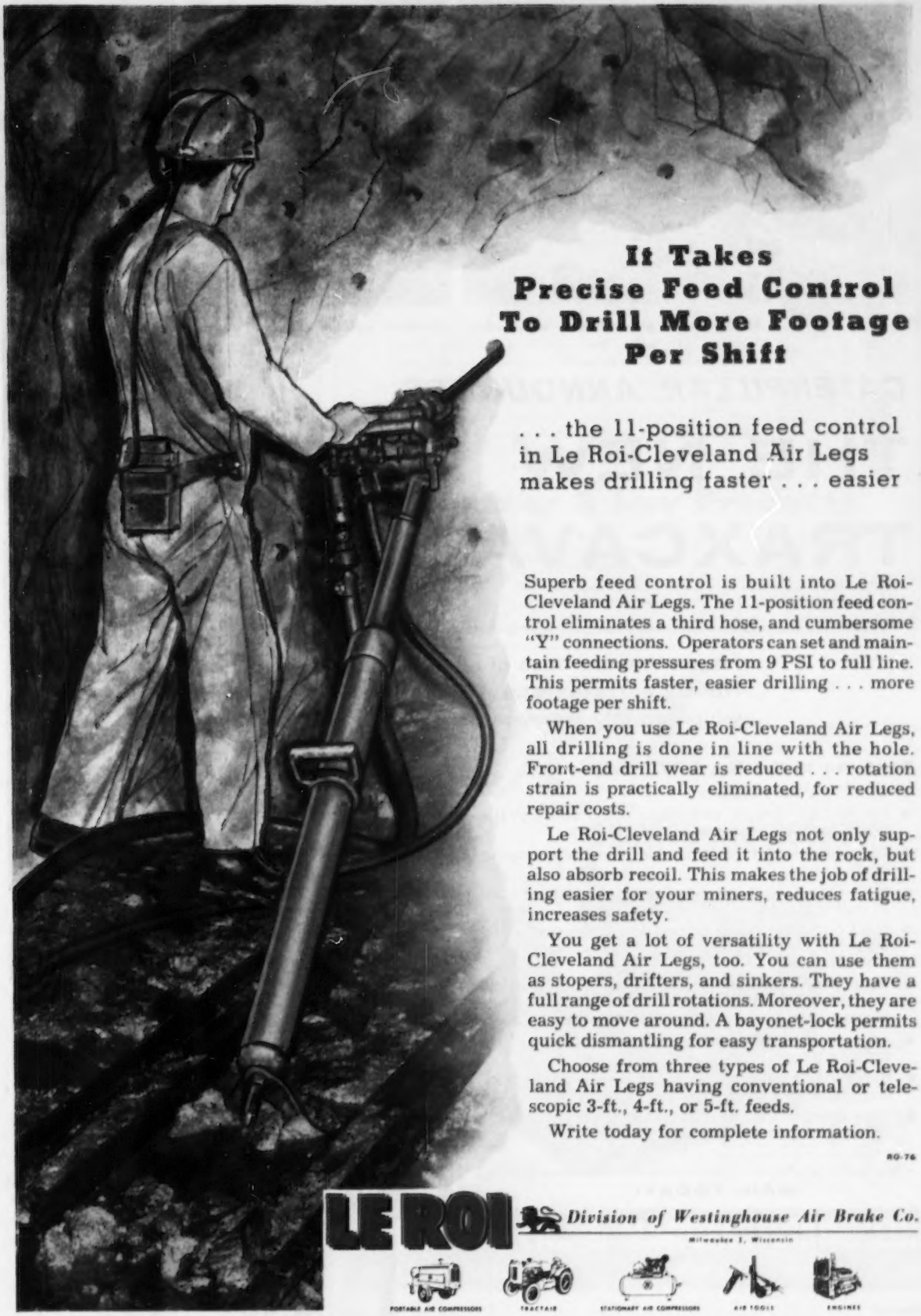
Iron ore shipping rates on the Great Lakes were raised 10¢ per ton in July 1955.

Predictions are already being made for a Lake Superior area total shipment of from 85- to 90-million tons in 1956. It is estimated that stocks of ore on hand at lower lake docks and mills will be down to 15-million tons by this spring. Increasing shipments of high grade imported ores have made steel plants more exacting in their standards for domestic ores.

High iron with controlled silica and moisture of taconite, concentrates also furthers this tendency. Margin ores with high silica, high moisture and low natural iron content are facing a more difficult situation than ever before. With ore imports from foreign sources being carried on all through the year, there may be less all-rail ore shipped from the Lake Superior district this winter than heretofore.

On Saturday, Nov. 12, Lerch Brothers', Inc. laboratory at the Mahoning mine completed its two-millionth sample since the laboratory was opened in 1895. This was a four-car shipping sample from Group 4 of the Mahoning mine operated by Pickands Mather Co. The laboratory's one-millionth sample was received 15 years ago, in 1940.

Among the M. A. Hanna Co., mines conducting a winter stripping program are:



It Takes Precise Feed Control To Drill More Footage Per Shift

. . . the 11-position feed control in Le Roi-Cleveland Air Legs makes drilling faster . . . easier

Superb feed control is built into Le Roi-Cleveland Air Legs. The 11-position feed control eliminates a third hose, and cumbersome "Y" connections. Operators can set and maintain feeding pressures from 9 PSI to full line. This permits faster, easier drilling . . . more footage per shift.

When you use Le Roi-Cleveland Air Legs, all drilling is done in line with the hole. Front-end drill wear is reduced . . . rotation strain is practically eliminated, for reduced repair costs.

Le Roi-Cleveland Air Legs not only support the drill and feed it into the rock, but also absorb recoil. This makes the job of drilling easier for your miners, reduces fatigue, increases safety.

You get a lot of versatility with Le Roi-Cleveland Air Legs, too. You can use them as stopers, drifters, and sinkers. They have a full range of drill rotations. Moreover, they are easy to move around. A bayonet-lock permits quick dismantling for easy transportation.

Choose from three types of Le Roi-Cleveland Air Legs having conventional or telescopic 3-ft., 4-ft., or 5-ft. feeds.

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40° tip back at ground level to hold load.

High lift, with over 11½ ft. of dumping height.

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Here's the new boss of all excavator-loaders... the new Caterpillar No. 977 Traxcavator. The No. 977 has important new features which greatly increase productivity and earning power.

Features of the No. 977 Traxcavator

- 96-in., 2¼-cu.-yd. bucket.
- 100 HP CAT* Engine, with ample power to "bury" the bucket and lift big loads.
- Bucket tips back 40° at ground level to retain heaping loads.
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- Steel bumpers on lift arms allow rapid jarring of bucket, and 50° discharge angle helps to empty sticky materials fast.
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- Advanced hydraulic system, with pump protected by full flow filter.
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- Fast, one-hand bucket operation. High seat for comfort and visibility.
- Five forward speeds to 7.4 MPH; four reverse speeds to 7 MPH.
- Each track controlled by heavy-duty dry multiple disc steering clutch and contracting band brake.
- Tools for any job: 3-yd. bucket for light material; 9-tooth quarry bucket; heavy-duty bucket; skeleton rock bucket; log and lumber fork.

Now three sizes of Traxcavators are available for all your excavating and material-handling needs. They're *unit-built* machines, so efficient that you'll find they match or excel competitive equipment with nominally greater bucket sizes. You can choose the right Traxcavator for your job from the No. 933 (1 cu. yd.)—the No. 955 (1½ cu. yd.)—or the No. 977 (2¼ cu. yd.).

Let your Caterpillar Dealer show you how these new machines can make money and *save* money for you. Get full details from him. Or mail the coupon below.

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LEADERSHIP IN ACTION

Minnesota *(Continued)*

Parcel Three; Morton; Douglas; Cooley district mines; the Mississippi group; the Perry and Cuyuna Range mines.

Many Mesabi Range concentration plants had sufficient ore in stockpile, accumulated during times when railroad cars were not available, to continue shipping concentrates after cold weather had closed plant operations for the season.

Meeting of the Minerals Beneficiation sub-section of the AIME was held at Chisholm Nov. 30. J. H. Strassburger, vice president of Weirton Steel Corp., guest speaker, discussed "The Effect of High Grade Raw Materials on Blast Furnace Operation," an important matter to the Mesabi Range as the competition of high grade ore from Canada. Labrador, Venezuela, etc. makes heretofore marketable lower grade ores less essential.

Petitt mine of the Jones & Laughlin Steel Corp. at Gilbert, which shipped its first ore as an open pit operation during the 1955 season, is carrying on a three-shift stripping program this winter. The Petitt and Schley, both former Republic Steel Co. properties which are adjoining, are operated by Jones & Laughlin as a unit. The two mines contain an estimated tonnage of over 6-million tons. Republic operated the Petitt from 1902 to 1923 and the Schley from 1910 to 1923. From 1941 to 1945, the Schley was operated by the E. W. Coons Co. for North Range Mining Co.

MONTANA

Golden Anchor Mining & Milling Co. has installed a new diesel generator and new milling equipment at its property in Powell County south of Elliston and expects to start milling in the near future, president Henry L. Newmiller reports. Initial capacity will be 50 tpd ore, but the plant has been designed for expansion at a later date.

Newmiller said an estimated 30,000 to 40,000 tons of gold-silver-lead-zinc ore have been blocked out at the company's 46-claim property.

Approximately 4,000 tons of lead-zinc ore has been blocked out at the St. Paul property in Lincoln County near Libby when work was suspended for the winter in November. The three-claim property is being developed as a joint venture by Silver Star Mines Inc. of Wallace and ORO Mining Syndicate of Kellogg, Idaho. The new No. 3 tunnel was driven 140 ft on the vein this year and some 300 tons of ore were stockpiled from development. Value of the stockpile and the ore reserves is estimated at $150,000 after mining, hauling and milling charges, figuring 10% combined lead-zinc content and an average of 14¢ a lb for the metal.

Young-Montana Co., of which E. A. Young of Hibbing, Minn., is president,

(Continued on p 152)

NO HOLE CAVE-INS HERE

Intra-Set Drill Steel—carbide insert—gauge sizes: 1⅛" thru 2¼".

thanks to small-hole Rok-Bit drilling

Drill blast holes faster—load them easier, with no costly cave-in problems—by using (1) airlegs, (2) drilling small holes, (3) with carbide Rok-Bits® on Brunner & Lay rods. For proof of what this accepted 3-step technique can mean to you in keeping your costs down, output up and drillers happier—write our nearest plant. Small holes, or large, we have bits for them all—ask for Bulletin B-1.

Carbide Rok-Bits—cross, "X" or chisel types—gauge sizes: 1¼" thru 6".

Alloy or carbon drill steel.

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Brunner & Lay, Inc. 150 Leslie St., Dallas, Texas

Brunner & Lay Rock Bit of Asheville, Inc. Sweeten Creek Road, Asheville, N.C.

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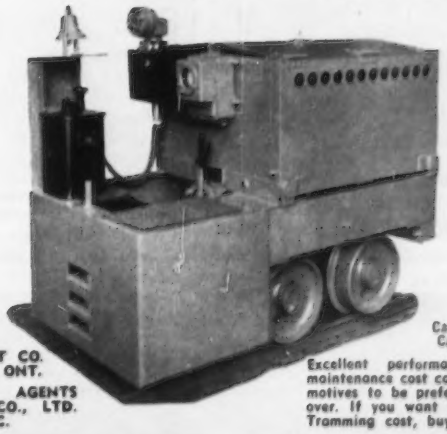

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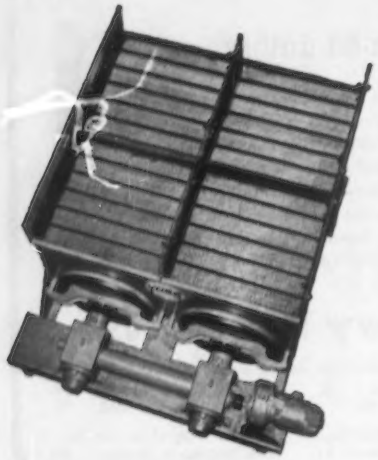
for mills and dredges



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GOLD	SCHEELITE
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YUBA jig action is positive. Just set to desired speed and stroke, get constant uniform pulsations that create surface action over full area of jig bed. Result: YUBA M-8 jigs have large material capacity per flow line under full control.

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YUBA jig design saves space, increases production in new or old dredges or mills. Use to supplement existing jigs or replace other concentration methods. For details of adapting YUBA jigs to your operation, send us data on ore, feed sizes and present installation.

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Fourteen Industry Advisor Committees Set: Will Act as a Forum on Mineral Problems

INTERIOR DEPARTMENT'S OFFICE of Minerals Mobilization has 14 new industry advisory committees to serve as a forum for producers' problems. Secretary McKay set them up under authority from the President's cabinet minerals policy committee, which recommended improvement of that liaison between industry and government in a report late last year.

The new committees cover aluminum, antimony, asbestos, beryl, chromite, columbium, tantalum, copper, fluorspar, lead, manganese, mercury, mica, tungsten, and zinc. Interior said they are made up of representative groups from independent, small, medium and large mining interests, by geographical area. First meetings of the new advisory groups are expected to get underway shortly.

The committees represent government's effort to meet increasing pressure from Congress and the industry to establish a standard policy on stockpiling and support programs (see page 118). However, the advisory groups will not deal with specific recommendations, acting rather as a forum for industry problems.

The new committees and their members are:

Aluminum Industry Advisory Committee: Robert K. Beck, Apex Smelting Co.; R. B. Caples, Anaconda Aluminum Co.; Richard L. Davies, Pennsalt International Corp.; Lawrence Litchfield, Jr., Aluminum Company of America; D. A. Rhoades, Kaiser Aluminum & Chemical Corp.; Walter L. Rice, Reynolds Metals Co.

Antimony Industry Advisory Committee: James P. Bradley, Bradley Mining Co.; William B. Clancy, American Smelting & Refining Co.; Marc S. Goldsmith, Goldsmith Bros. Smelting & Refining Co.; Robert M. Hardy, Jr., Sunshine Mining Co.; J. W. Iliff, Harshaw Chemical Co.; F. S. Mulock, U. S. Smelting Refining & Mining Co.; Robert L. McGean, The McGean Chemical Co.; Frederick R. McIntosh, C. Tennant Sons & Company of New York; Walton S. Smith, Metal & Thermit Corp.; W. J. Welch, National Lead Co.

Asbestos Industry Advisory Committee: Miles V. Engelbach, The Ruberoid Co.; D. W. Jaquary, Jaquary Mining Corp.; J. C. Kelleher, Johns-Manville Corp.; Charles R. Neal, Metate Asbestos Mines Corp.; S. R. Zimmerman, Jr., Raybestos-Manhattan, Inc.

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Record Tonnage Produced at Navajo Uranium Division

WEMCO *Equipment Resists Highly Abrasive and Corrosive Treatment*

New $3,000,000 Uranium producing mill of Kerr-McGee at Shiprock, N.M. built by WKE Division of Western Machinery Company.

Wemco Diaphragm Pumps handling thickener underflow are simple to adjust and service.

The new $3,000,000 plant built for Navajo Uranium Division of Kerr-McGee Oil Industries selected equipment on the basis of resistance to highly abrasive and corrosive conditions.

This new uranium plant at Shiprock, New Mexico, utilizes an acid cure flowsheet new to uranium processing. While much of the process is highly secret, it is well known that the corrosive acid content is high and damaging to equipment. Also, the fast settling coarse sands create an abrasive action which constantly exposes new surfaces to the adverse effects of corrosion.

Wemco Equipment in Flowsheet

Following grinding and screening, the liberated uranium ore is processed for repulping through WEMCO rubber covered agitators producing a pulp approximately 50% solids.

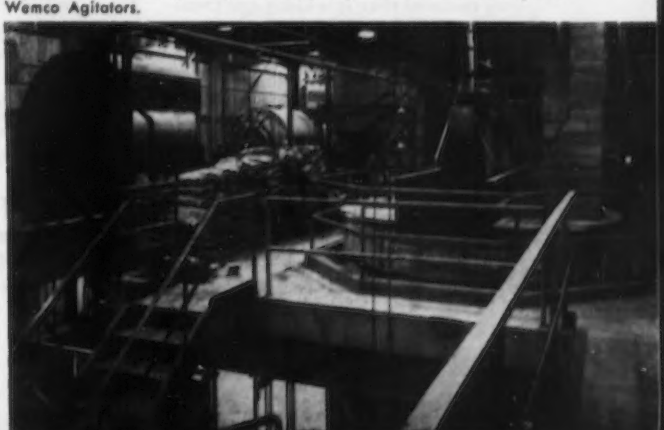
From the WEMCO Agitators the pulp flows through four WEMCO Spiral Classifiers in the modified CCD system for sand-slime separation. Exposed rotating parts of the classifiers are stainless steel with the spiral flights and tanks rubber covered to resist acid and abrasion. Acid proofing of the classifiers, including the submerged bearings and spirals, has been 100% effective. Flights can be added changing the classifiers from single to double or triple pitch if additional capacity is desired.

Underflow from the thickeners is handled in special acid resistant WEMCO Diaphragm Pumps. These pumps are designed for ease of maintenance and handling, with replacement of wearing parts reduced both in time and in frequency.

Precipitation of the final product utilizes specially developed WEMCO Agitators in part of the flocculating process.

Acid-abrasion resisting Wemco Spiral Classifiers eliminate approximately 60% of barren sands in the modified CCD system of Navajo Uranium.

Repulping, conditioning and part of the precipitation is handled in special Wemco Agitators.



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The Crescent handles 480 yds. or 720 tons per hr. over an average haul from 300 to 350 ft. It operates along a 675-ft. span between movable head and tail towers located at the base and top of the 240-ft. high bank.

In addition to high rate of delivery, adoption of the Sauerman Method provides two other advantages over the 5-cu. yd. power shovel that formerly operated off the "toe" of the bank. These are: (1) material can now be taken from anywhere on the bank for blending and selection of gravel, and (2) material can be moved down the slope with no danger of cave-ins.

The tower excavator at Pioneer is mounted on portable towers and engineered by Sauerman for economical excavation in this type of deposit. This same digging tool . . . the Crescent scraper . . . can be engineered to your operation to give you equivalent high production at low cost.

Sauerman Scrapers range from ½ cu. yds. up to 18 cu. yds.

Because in most cases it is cheaper to drag material than it is to lift and transport it, *they give you the lowest cost per cu. yd. handled.*

Contact us for information and specific recommendations. Ask for field reports and Catalog A.

This view gives some conception of the height and steepness of the bank on which the Crescent works.

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OMM *(Continued)*

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Montana *(Continued)*

is developing a property about 75 miles south-east of Great Falls, near Stanford. Company is said to have about 1-million tons of high grade ore proved up. The ore which will be mined by open pit methods, resembles the underground ore in the Ely-Tower area of Minnesota's Vermilion Range. It outcrops and will not require initial stripping. It is planned to ship from 75,000 to 100,000 tons in 1956 from the area in the Running Wolf. Range. Joseph Lovallo of Mt. Iron, Minn., vice president of the company, will be in direct charge of operations. Diamond drilling is being pushed. The new property is expected to require an investment of about $300,000 in equipment and supplies. Arthur Clure, Duluth, is secretary-treasurer of the company.

Young reported that the iron ore will be shipped to Lake Superior ports to be used in the Lake Erie district.

Anaconda Aluminum Co. plant at Columbia Falls has reached its rated capacity output of 60,000 tons a year. First aluminum was produced at the plant on Aug. 12, 1955.

Laurence Berry, Polaris mine lessee, and Lee M. James of Dillon, Beaverhead County, have entered a partnership in the operation of the Polaris property west of Dillon.

NEVADA

Minerals Engineering Co. has signed an option contract with Comstock Uranium and Tungsten Co. which may lead to development of a 1-million ton low-grade tungsten property south of Hawthorne in Mineral County.

R. G. Sullivan, Mineral's vice president at Grand Junction, Colo., said the contract will not be exercised unless ore-grade check now being carried out proves up.

He said that Comstock Uranium and Tungsten (not to be confused with Comstock Uranium Corp., a Utah firm) had spent $50,000 in coring the tungsten outcrop. However, the cores were too broken to determine ore grade.

He is optimistic about the potential, he said. The evaluation report will be completed early this month.

Should Minerals determine to go ahead with open cut mining at the Mineral County property, a substantial-

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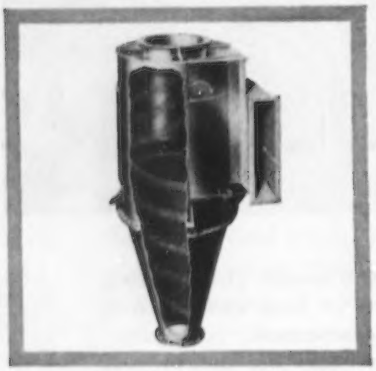

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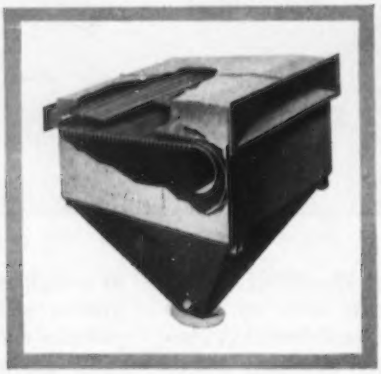

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Nevada *(Continued)*

sized mill would be erected on location.

Primary interest of Minerals Engineering is continued development of concentrate supplies for its Salt Lake Tungsten Co. refinery in Salt Lake City.

Refinery is 50-50 owned by Minerals and Sylvania Electric Products Corp.

Under the option contract signed between Minerals and Comstock Uranium and Tungsten, Minerals would receive 75% and Comstock 25% of net profits from sale of concentrates.

At 1:15 on the afternoon of Nov. 19 more than 2-million tons of earth "let go" at the northwest corner of the Liberty Pit at Ruth, sending a mammoth landslide into the Kennecott Copper Corp.'s open pit property and killing one man. The Liberty Pit is reported to have been weakened at the rim as the result of recent snowfall. The great land mass fell 550 ft onto Level 13½, where three men were working. Another man, employed nearby, saw the slide start, and shouted a warning to the other three. Two ran to safety—but one was trapped by the falling earth and buried beneath tons of material. His body was recovered later by aid of a bulldozer.

A Kennecott Corp. spokesman, Frank Quilici, said the slide is believed to have been caused by water runoff from the snow. Extensive work has been in progress ever since the slide to repair the damage done to the pit.

Extensive test drilling operations are being carried on by the Hercules Mines Co. on Lander Hill near Austin, with the expectation of locating rich silver and copper veins. Frank Chartier, of Reno, president; Alex Ferguson, of Tonopah, vice-president; and Richard Sanguinetti, of Reno, secretary of Hercules Mines Co. are in charge of the operations.

Geologists have outlined the positions of what are believed to be several large veins of silver left untouched during the early Austin mining boom, and have indicated a rich copper deposit. During previous operations only shallow trenches and surface operations were carried out on that side of Lander Hill, which is known to be rich in mineral deposits.

Gold Metals Co. has cut the first showing of good uranium ore near the 150-ft mark of its mine at Belmont in Nye County. The ore is a fracture having the same strike as the high-grade stringers which show on the surface. The autunite being encountered in the footwall indicates the ore zone will have good width. James Gavin and Bob Benjamin, tunnel contractors, have progressed 150 ft in 25 working days. Harry Hughes, of Goldfield, is mining geologist in charge of the exploration work.

Happy Joe Mine near Mountain City in northern Elko County is getting good financial return from shipments of uranium ore. Eight cars of 45 tons each recently sent to the smelter returned values of .34% for a yield of $46 per ton for five of the cars, and .5% for a

Kaiser Steel replaces four churn-type drills with one Bucyrus-Erie rotary

At its Eagle Mountain operation 175 miles east of Los Angeles, Calif., Kaiser Steel Corporation recently retired four machines from its fleet of six churn-type blast hole drills after adding a single Bucyrus-Erie 50-R rotary.

Three Times the Footage

Production figures covering six months of operation showed that the rotary unit, drilling 9⅞-in. holes an average of 35 feet deep, could deliver **three times** as much footage per drilling hour as a churn-type unit drilling 9-in. holes. The material drilled was a massive ore formation, high in iron content and considerably heavier than most rock formations.

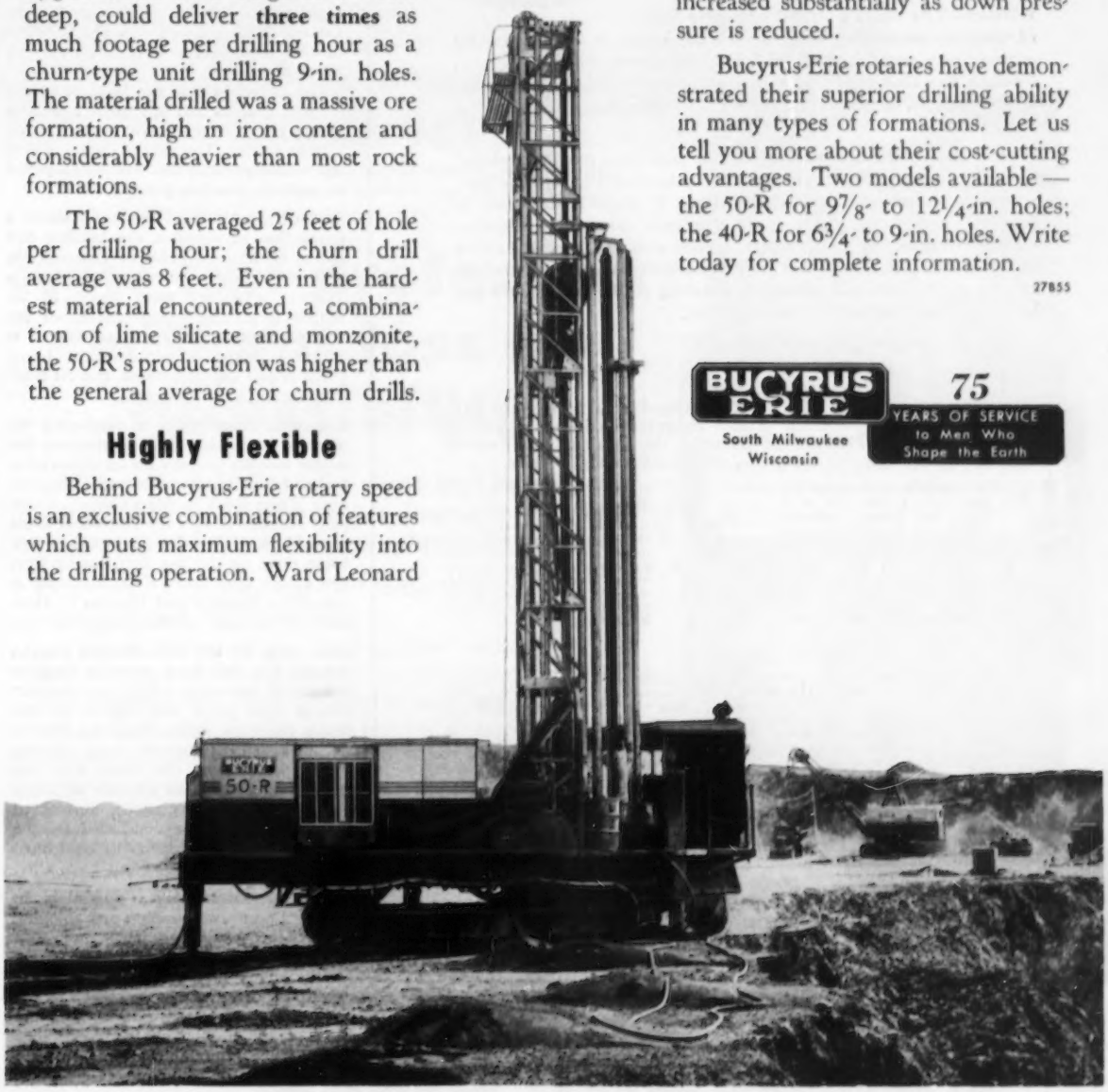
The 50-R averaged 25 feet of hole per drilling hour; the churn drill average was 8 feet. Even in the hardest material encountered, a combination of lime silicate and monzonite, the 50-R's production was higher than the general average for churn drills.

Highly Flexible

Behind Bucyrus-Erie rotary speed is an exclusive combination of features which puts maximum flexibility into the drilling operation. Ward Leonard electric control of drill rotation speed permits the operator to choose the most efficient speed for a given formation — to accelerate or decelerate as required without stopping the drilling operation. Hydraulic motor control of pull-down permits him to adjust down pressure correspondingly. In hard formations, maximum down pressure may be exerted on the bit while the drill pipe is turning slowly. In soft material, rotating speed can be increased substantially as down pressure is reduced.

Bucyrus-Erie rotaries have demonstrated their superior drilling ability in many types of formations. Let us tell you more about their cost-cutting advantages. Two models available — the 50-R for 9⅞- to 12¼-in. holes; the 40-R for 6¾- to 9-in. holes. Write today for complete information.

27B55



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As shown by illustrations (1) and (2), a *pull test* is a static test having negligible bearing on the magnet's ability to attract rapidly moving iron. It is not *dynamic*.

Illustration (3) shows a *lift test*, again a static test having negligible bearing on the magnet's ability to attract moving iron. It is not *dynamic*.

Illustration (4) shows a *chute test* . . . the only *true* test of a plate magnet's ability to attract rapidly moving iron. *This is the DYNAMIC principle of operation of the new Dings Perma-Plate Magnets.*

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Complete details of these versatile DYNAMIC Magnets are given in the new Catalog 1205-D, just off the press. Mail coupon for your copy.

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PP155½

Nevada *(Continued)*

yield of $130 per ton for the other three cars. Indications are that the mine is of major proportions. Leon and Joe Belaustegui, of Battle Mountain, and Otto Radley, of Auburn, Calif., owners and operators of the property, reportedly have pinpointed two veins which intersect.

One vein measures 100 ft, and the other measures 25 ft. Ore has been uncovered for a distance of half a mile along the two veins, which have dropped to a depth of 20 ft.

Construction of a 100-ton mill on the Shawano Corp. Bretz Mercury Mine property west of McDermitt in northern Humboldt County is planned for early spring. J. P. Hart, of Reno, superintendent of the mine, says an extensive development program was carried out during the summer which included 7,000 ft of churn drilling which hit high grade ore on the second hole. Lowest depth reached was 105 ft where the bit reached the bottom of the ore horizon.

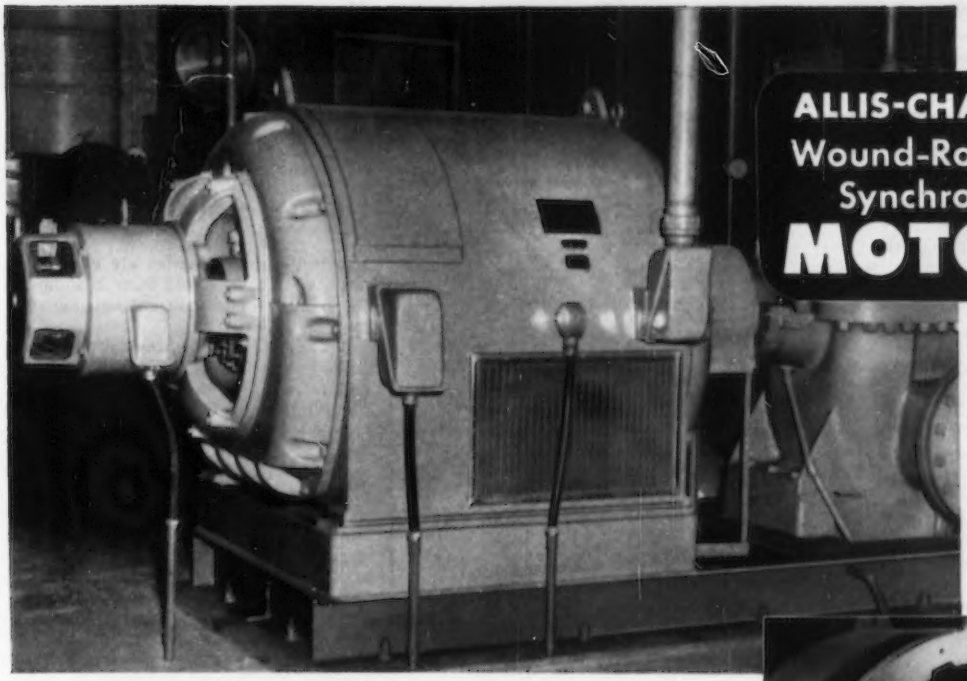
Ore found to date has been in opalite formation areas and in regular tufaceous "lake beds" which have been highly altered to clay. The mine is closed during the winter months, but will be reopened as soon as weather permits.

Wah Chang Mining Corp. has reached a production of tungsten ore totaling 825 tpd at its Lincoln Mine in Tempiute. A total of 700 tpd are being milled on a 24-hour seven-day week basis. E. G. Woods is general superintendent of the Lincoln Mines division, John Russell is assistant general superintendent, Larry Davis is mill superintendent, and Al Nielson is mine superintendent.

Edgemont Mining Co. is employing six men on a two-shift basis throughout the winter months to carry on an exploration and development program at its property near White Rock in Elko County. Company recently bought the Edgemont Mine from C. H. Jackson Jr., and work is now being done on the Big Bob, Lucky Boy, and Lucky Girl veins. E. S. McCurdy is consulting engineer and Thomas C. Hedlund is manager of the Edgemont Co.

Since Oct. 17 the Consolidated Eureka Mining Co. has been shipping approximately 10 tpd ore to a Salt Lake smelter. Ore is high grade and typical of that which made the camp of Eureka famous in the so-called Bonanza days. Sinking of the winze from the 300-ft level has been resumed and an advance of about 5 ft per day is being made. Sinking of the winze should be concluded by the first of the year. Property is controlled by the Hogie interests of Salt Lake City.

Barium Products, Ltd., operation in Lander County was mining and shipping approximately 400 tpd barite ore until Dec. 1, at which time the plant closed for the winter months. Company is now developing a new property known as the Argenta, 12 miles from Battle Mountain. Most of the production has come thus far from the Mountain Springs Mine, 26 miles from Battle Mountain, G. M. Stark



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All parts, including slip rings and leads, are enclosed — yet removable inspection covers and end-shield sections simplify maintenance.

These motors combine modern functional design with maximum protection and accessibility.

Here are some of the important features:

- Collectors and brushes are protected by box-type stator yoke from physical damage, dripping moisture, dust and dirt.
- Cast end shields provide rigid bearing support and full protection for motor windings.
- Slip-ring leads are brought out to a terminal box — they are not left exposed.
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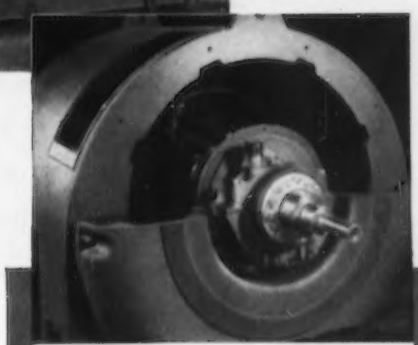
Get details — Call your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin. Ask for Bulletin 05R8183.



Note accessibility offered by generous size opening covers. Upper half of end shield is removable for entrance to motor winding.

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Nevada *(Continued)*

is resident manager, A. L. Allen is mining engineer, and Jim Jury is mine superintendent of the Barium Products Nevada operations. Barite produced is shipped to Modesto, Calif., for processing.

NORTH CAROLINA

Explorations for tungsten are under way in the old Phoenix gold mine in southern Cabarrus County, with encouraging preliminary reports.

The mine—once a heavy producer of gold—has been leased from A. L. Nash and reopened by a new firm, Carolina Tungsten Mining Co. Officials of the firm are Hal Lackey of Washington, D. C., president; Paul M. Tyler, formerly affiliated with the U. S. Bureau of Mines, who is vice president; and Arthur Rothwell of Connecticut, secretary-treasurer.

Main section of the 600-ft shaft has been pumped free of water and officials of the company say they are finding "highly encouraging" traces of scheelite. The company also has begun exploratory operations in the 170-ft shaft of the adjoining Furniss property, in search of tungsten. The bottom 70 ft are still under water but operations have begun at the 100-ft level.

"Results of the bulk sampling at the Phoenix and the quantity of tungsten at the Furniss mine may justify erection of a mill," Lackey said.

OREGON

Quick Silver Syndicate, owners of the Blackbutte mine properties inactive since 1942 but once a heavy producer of mercury, have assigned mines to New York City investors, presumably for development in the current upsurge of interest in Oregon mercury prospects. Mr. and Mrs. Fred Mills, Jack Mills, officers of the syndicate, report O. N. Schutte, who in 1938 authored Oregon Department of Geology & Mineral Industries' Bulletin on quicksilver in Oregon, represented the leasors in the deal as consulting engineer.

The cinnabar prospect was discovered in 1898 and has produced an estimated 1-million lb of mercury. The Blackbutte mountain ghost-town is 18 miles south of Cottage Grove.

Lakeview Mining Co. has shipped three carloads of ore from the Lucky Lass and White King uranium prospects in south-central Oregon and Vance and Dr. Garth Thornburg, Grand Junction, Colo., report if core drilling bares sufficient orebody, a concentrating mill may be erected at Lakeview. The ore presently is being shipped to Vitro plant, Salt Lake City. Thornburgs reported they hold a quarter interest in the properties and other interests are held by Clint Murchison, Sid Richardson and Perry Bess, Texas oil operators.

An Oregon drugstore clerk—a widow

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Honeywell Instrumentation

Temperatures and pressures for a typical baghouse installation are controlled by Honeywell instrumentation as diagrammed here.

UP-TO-DATE Honeywell instrumentation can make the task of collecting dust from mineral beneficiation processes highly efficient and thoroughly automatic. It can keep the baghouse operating within prescribed limits . . . help to reduce loss of valuable product in flue gases . . . eliminate sources of excessive wear and maintenance in plant equipment . . . and maintain working conditions that spell maximum safety and comfort of employees.

Honeywell instrumentation includes automatic, interlocked control of temperature and pressure. As shown in the diagram, an *ElectroniK* instrument regulates a tempering air damper to hold constant the temperature of gases flowing to the baghouse. Should flue gases become excessively hot, more tempering air is automatically fed to the mixture, to protect the bags against burning or gumming.

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Oregon *(Continued)*

without income who owns a gold mine inoperative because the pegged price of bullion is below cost of mining the ore has carried an appeal to the 9th Circuit Court of Appeals, San Francisco, from dismissal of her U. S. District Court suit questioning Constitutionality of the 1934 Executive order. Mrs. Gladys Laycock. Prairie City, inherited the mine from her father.

SOUTH DAKOTA

Sodak Uranium and Milling Co. shipped 1,083 tons uranium ore to the mill at Edgemont in October, best shipping month so far. Sodak reportedly has some 25,000 tons proven ore on its Busfield and Too Late properties and recently acquired mining rights to the Hawthorne Ranch in South Dakota and Wyoming.

UTAH

Centennial Development Co. has contract for sinking a 2500-ft incline shaft in the North Alice Group of claims in the Big Indian District of San Juan County, Utah, for Homestake Mining.

According to authoritative Moab, Utah, sources, Homestake during last year has blocked out more than 200,000 tons of low-grade uranium ore in the claims adjacent to the Daniel and Ruddock (Almar Minerals) orebody. Ore in place is reputed worth up to $7-million.

Correction

IN THE OCTOBER 1955 issue, *E&MJ*, in the Idaho news section on p 140, an item concerning purchase of the Ransom Uranium mine in Cottonwood Wash, Utah by a newly-formed Idaho firm was in error. Story of the purchase, by Uranium Discovery and Development Co. and Uranium Prince Mining Co., and statement that National Lead Co. would develop the property on a profit-sharing basis, was also incorrect.

The King Edward and King James mines are part of a large group of claims owned and operated by the Ransom Bros. Mining Co. and, according to Ray Ransom, "have not been sold or divided."

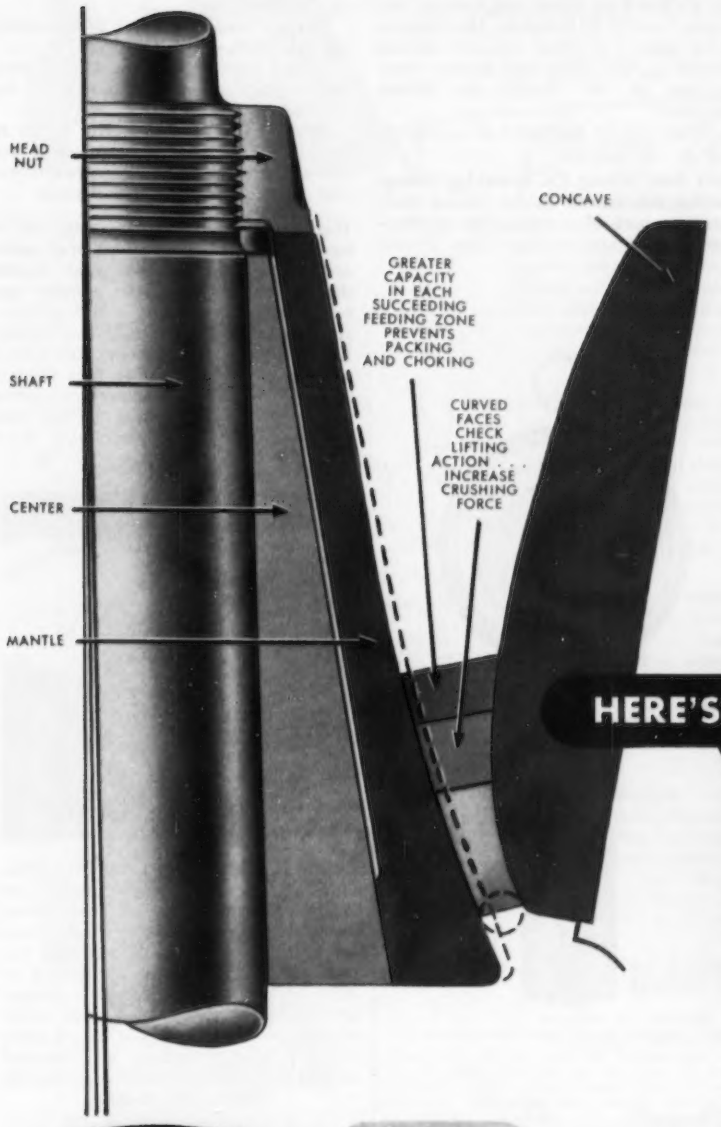
E&MJ regrets the error and apologizes to all parties for any embarrassment the publication caused.

W. D. Nebeker, president of Federal Uranium Corp., said production from that company's Radon shaft in the Big Indian district of San Juan County should reach 200 tons per day by Jan. 1.

The Radon is being operated by Hecla Mining Co. for Federal. Orebody has been conservatively estimated at $21-million.

Principal interests in the Daniel-Ruddock uranium orebodies San Juan County, Utah, were sold in two separate transactions involving $11,350,000.

IT'S NO SECRET . . .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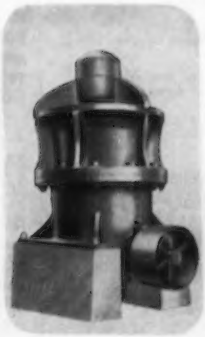

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Utah *(Continued)*

Atlas Corp., headed by financier Floyd B. Odlum, acquired through subsidiary Hidden Splendor Mining Co. the holdings of Almar Minerals Corp. of Homestake Mining Co. and W. E. McCormick et al of Bountiful, Utah for $8-million.

And Federal Uranium Corp., in which Odlum is a figure, gave option to Moore and Schley, New York brokers, for purchase of its 33½% interests for $3,350,000.

The option is exerciseable in six months.

Almar Minerals, a Ruddock-family controlled firm, received an estimated $6.8-million for its 51% interest in the Daniel-Ruddock holdings.

More than $1.2-million was paid Homestake Mining and W. E. McCormick group of Bountiful for their holdings, placed at 15½% interest.

Of that amount, Homestake received about $1-million and McCormicks, former residents of Moab, Utah, more than $200,000.

The transactions now give Hidden Splendor full ownership of the ore in the claims, where a 530-ft three compartment shaft has been completed.

Principals in Almar Minerals are Merritt K. Ruddock, Moab and Denver; Billingsley and A. B. Ruddock, Los Angeles. More than 700 other uranium mining claims on the Colorado Plateau were involved in the transfer to Hidden Splendor.

Almar will be liquidated as a corporation.

New Park Mining Co. is seeking a large bedded ore deposit in the Desert limestone as part of a stepped-up development program at its Park City District properties in Summit County, Utah.

Company, currently engaged in sinking a three compartment shaft to about 2250 ft following installation of a powerful new hoist earlier this year, also has laid ground work for higher mining pace from three known fissures.

W. H. H. Cranmer, company president, said the shaft was now bottomed at 2065 ft while crews commenced cutting stations.

Deepest station work is being carried out now on the 1880-ft level.

A new station is on the 1775-ft level and a third station will be cut on the 2005 level.

By July 31, 1956, the firm hopes to have four or five levels prepared for mining from the Pearl, West Mayflower and No. 3 lead-silver-zinc fissures.

Western Gold & Uranium, Inc., which has been exploring its Silver Reef mines at Leeds, for the last three years, reports that since both silver and uranium are being found in ores, it will start construction of a flotation mill next spring. Mill, with a 50-tpd capacity, will extract silver from the ore before it is shipped to the uranium buying station. According to the company, it will be the first mill built in the district since the silver bonanza of the 1880s.

Parker H. Childs, miner for Five States Uranium Corp., dumps Scoot-Crete shuttle car at portal of Five States' Tomsich Mountain mine on San Rafael Swell, Emery County. Five States secretary-treasurer Webster H. Russell of Albuquerque, said the company shipped and stockpiled about seven loads of ore encountered in drifting to an orebody found by earlier drilling, and expected to ship two loads daily after reaching the blocked out channel.

A number of major companies are reported preparing to bid on construction and operation of a new uranium salts refinery proposed by Atomic Energy Commission.

Some of them seek a western location —possibly Salt Lake City—for the $6-to-$8-million facility capable of turning out 5,000 tons annually of uranium salts.

It is reported by those preparing material for the bid that supplies of hydrofluoric acid and other materials along with availability of domestic uranium concentrates in the west can be coupled by reported demand by AEC that the refinery be "dispersed" industrially with

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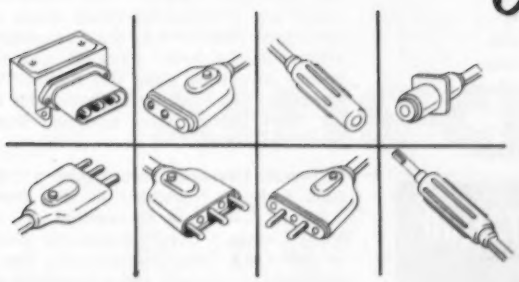

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Utah *(Continued)*

the placement of the refinery in Salt Lake City.

The proposal is regarded as an excellent opportunity for major companies in the uranium mining and concentrating field to extend operations into salt refining—which takes 90-plus valued uranium oxide up to 99.997% uranium salt.

The salts later are converted to uranium hexafluorides of metals in shapes or billets.

Atlas Uranium Corp (no relation to Atlas Corp.) made headlines early in December with announcement it has blocked out copper ore valued at $2.5-million on two claims in the Lisbon Valley, San Juan County.

J. C. Burgess, president of Atlas, said plans for a mill are being studied, and that it already has been determined the ore can be processed at a profit. The company has 19 adjacent claims which now are being drilled.

Atlas made its strike in August, Burgess said, but withheld details until it was certain a major deposit had been located.

Lucky Mc Uranium Corp. has upped its monthly uranium ore shipment allotment from about 1,500 to 3,000 tons, W. H. H. Cranmer, president, reports.

Cranmer said that Utah Construction Co. reports encouraging results to date on a two-fold project at the Gas Hills, Fremont County, Wyo. mine which aims at ore reserve development and test of mining methods.

A large dragline has been installed and is apparently meeting the requirements of open pit mining in the area.

Salt Lake Tungsten Co. planned to move its new high purity ammonia paratungsten plant in Salt Lake into operation in December, according to Blair T. Burwell, Jr. general manager.

Purpose of the facility being completed near main refinery of the company is to produce a material easily converted to powdered tungstate for the metallurgical trade.

This will lead to by-passing of a number of "end refining operations" required in processing of artificial scheelite now made by this and certain other tungsten refineries in the U. S.

By producing a more highly purified product, Salt Lake Tungsten (jointly owned by Minerals Engineering Co., Grand Junction, Colo. and electronics-maker Sylvania Electric Products, Inc) hopes to compete more handily with foreign-produced tungsten ores refined in this country.

WASHINGTON

Reeves MacDonald mine and mill have resumed full production after being shut down since July 1953 as a result of low lead and zinc prices. Jens Jensen, president of Reeves MacDonald Mines, Ltd., and its parent firm, Pend Oreille Mines and Metals, said the company is turning out from 900 to 1,000 tpd ore.

About 90 men are working on the properties in British Columbia, just across the international border from the Pend Oreille U. S holdings. Reopening of the Reeves MacDonald properties was begun in mid-October and milling resumed Nov. 1, two weeks ahead of schedule.

Late in September the firm began a shipment of 5,100 tons of zinc concentrates to the Great Falls, Mont., plant, and planned to complete the shipment before the end of November. Shipment of current production has also begun.

Jensen announced that Pend Oreille has filed another group of mining claims in the Metaline district. The company staked and recorded fractional claims to cover land withdrawn by the Government years ago for water purposes and reopened to mineral entry this summer by Congress. The land lies on both sides of the Pend Oreille River upstream from Z canyon.

Daybreak Uranium, Inc., signed a contract early in November to ship from 2,400 to 5,400 tons of uranium ore to Vitro Uranium Corp.'s processing plant at Salt Lake City. Contract calls for a minimum of 400 tons and a maximum of 900 tons monthly.

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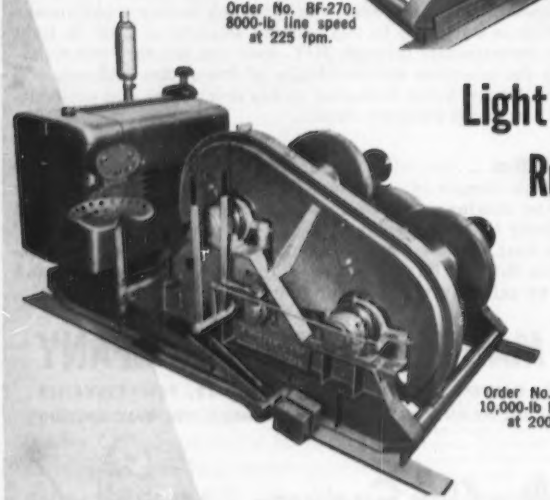

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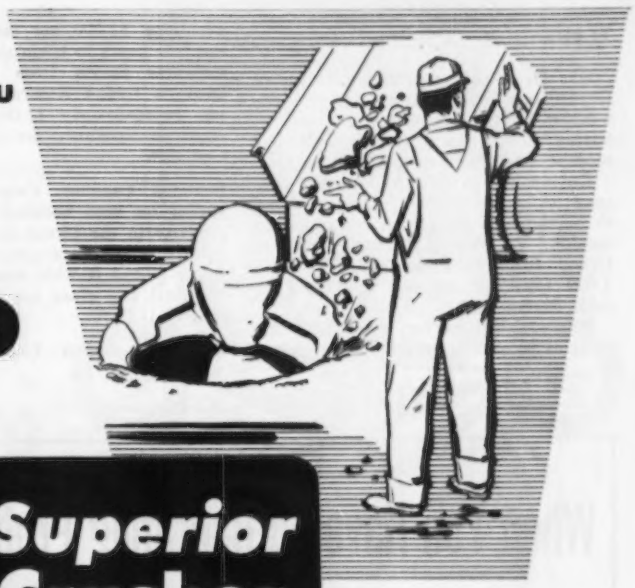
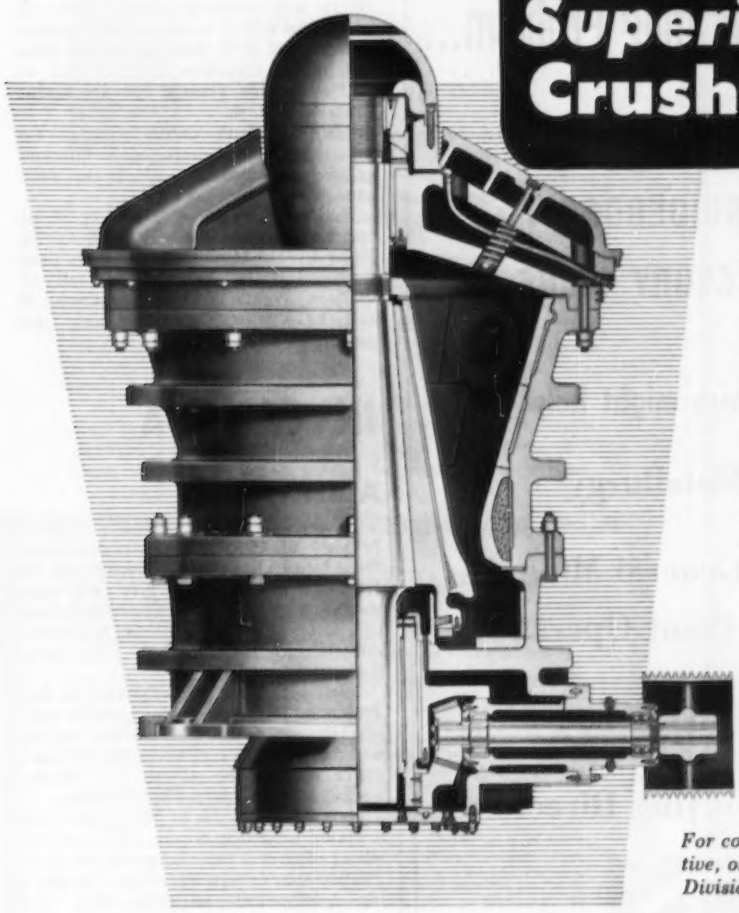


Superior Crusher



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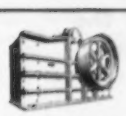
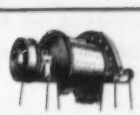

Jaw Crushers

Gyratory Crushers


Grinding Mills

Kilns, Coolers, Dryers

Washington *(Continued)*

Kae H. Sowers, secretary-treasurer of Daybreak, said the firm did not press for a larger contract because it feels an ore-buying station and processing mill may soon be established in the Spokane area.

Daybreak also received an AEC contract for an additional 500 tons of ore to be shipped to the former American Smelting & Refining Company mill at Grand Junction, Colo. This brings to 2,000 tons the amount contracted by AEC during 1955.

Daybreak has, so far, shipped 29 cars from its properties near Mount Spokane, averaging $5,000 per car. Sowers said the firm hopes to begin shipments within the next month from leases on the Spokane Indian Reservation. Daybreak has approximately 12,000 acres under lease in Spokane, Stevens and Ferry Counties.

National Uranium Corp. of Wallace, Idaho, has been bulldozing its 320 acre property in the Mount Spokane district. John B. Platts, geologist, is directing the work. A 150 ft wide shearing has been disclosed and plans are to explore this to a 10 ft depth.

Pacific Northwest Uranium, Inc. of Wallace is developing an important new uranium discovery on the Spokane Indian reservation in Southern Stevens County, about three miles south of Midnite Mine which is operated by Newmont Mining Corp. through a subsidary, Dawn Mining Co.

Discovery, first noted by means of airborne reconnaissance, has been opened by surface trenching over an area roughly 1,000 ft from east to west by 300 to 400 ft from north to south, and the work so far has not reached the limits of the ore zone in any direction.

The ore occurs directly beneath the surface overburden in a series of stratified beds which strike north and south and dip gently to the west. The beds consist of arkosic conglomerates, clayey sandstones and lignitic members of varying thickness in Nespelem sediments. Mineralization persists to the maximum depth thus far attained in the trenching, 20 ft, and chemical assays show an average of 0.13% uranium oxide content over the full 20 ft. Selected samples from the lignitic members run as high as 1.15% and the average for the lignitic strata is 0.643%.

The one fault encountered in the trenching so far indicates concentrations of ore mineralization along the fault zone.

Northwest Uranium is the operating company for a joint venture involving Silver Buckle Mining Co., Eastern Lead Corp., Fortune Mining Co., all of Wallace, Pathfinder Uranium Corp. of Salt Lake City, and Stansbury and Associates of Spokane.

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E&MJ's Mid-March Mining Guidebook and Buying Directory Issue now is an established annual service to E&MJ subscribers all over the world. The 1956 edition will be published in Mid-June, 1956.

IN CANADA

ALBERTA

In view of 1956 mining developments, the Alberta government's Department of Highways is expected to give early consideration to application for construction of a 150-mile winter road from Bitumont, Alberta, to the Uranium City area, Saskatchewan.

The application was submitted to the Provincial Highways Department by several interested operators in the region and the Uranium City Chamber of Commerce through the Alberta and Northwest Chamber of Mines in Edmonton.

Next year's volume of freight serves as a major argument for necessity of the winter road. It is expected to rise to some 150,000 tons in view of prospective mining developments in 1956—triple the volume of previous years.

The Chamber of Mines has stressed the urgency of the situation to Alberta Minister of Highways Gordon Taylor and to Hon. Jean Lesage, Federal Minister of Northern Affairs and Natural Resources.

There is a road from McMurray and Waterways to Bitumont, a distance of some 50 miles. An extension of the winter road would enable supplies to be moved overland during the winter—with the last stretch running across the ice on Lake Athabasca.

New *simplicity and sustained efficiency in dust filtering and collection...*

Dualaire*

REVERSE-JET DUST COLLECTOR

Efficiencies up to 99.99%

Cloth filter systems of one design or another have long been used by industry for cleaning industrial gases and/or recovering dust or other suspensions. But three problems are common to such systems... (1) Extreme changes in pressure drop and filtering efficiency as dust cakes accumulate on the filter surface... (2) Wide pressure fluctuations and surges in the plant system as filter units become clogged or are cut out and rapped for cleaning... and (3) Rapid deterioration of the filter material by the vibration, shaking and rapping equipment used for cleaning.

But now the DUALAIRE Collector—as engineered by Western Precipitation, pioneers in the field of dust recovery—provides the answer to these and other problems common to conventional bag-house equipment.

The Dualaire Principle is Simple, Efficient. **Basically, each Dualaire filter unit consists of a cloth or felt tube, open at both the top and bottom. (A) Dust-laden gases enter at top of the tube and are filtered as they pass through the side walls of the tube to the exhaust system. (B) Dust particles collect on the inside of the tube and *before* the cake builds up sufficiently to affect filter operation, a tubular blow ring (C) automatically starts moving up and down the outside of the filter cylinder. A jet of air, concentrated by this blow ring, reverses the normal gas flow at the point contacted by the ring, thus jetting the dust layer off of the inner surface of the filter tube.**

This jetting action is further assisted by a flexing of the filter cylinder as the blow ring passes, thus cracking and loosening the dust layer from the inner surface, from where it drops to the recovery chamber below the bottom of the tube.

The entire operation is positive and simple. The blow ring starts its action *automatically* as soon as the dust layer causes a pre-determined pressure differential. And after the filter surface is cleaned, the blow ring *automatically* stops.

6 ADVANTAGES OF DUALAIRE DESIGN...

PRESSURE DROP remains uniformly low at all times because the dust is removed continuously in *small portions.*

FILTERING EFFICIENCY remains uniformly high at all times without the "choking" action characteristic of conventional bag-houses. Actual field tests show efficiencies as high as 99.99%!

DUST RECOVERY is in steady increments—not in sudden large "batches" as with conventional rapping systems. Thus the Dualaire eliminates surges and detrimental variations in the plant system.

FILTER ELEMENT has a much longer life because it is not subjected to the stresses of rapping or jarring while being cleaned. Dualaire reverse-jet cleaning action is gentle, yet far more effective.

GREAT SAVINGS are also made in space and the size of installation required. Because each Dualaire filter unit is cleaned more-or-less constantly without shut-down, there is no need for costly standby units—or the complicated switching equipment to cut standby equipment in and out.

BASIC UNITS are "sectionalized" and are available in 5 standard heights. Sections can be bolted together in any desired multiple, providing a capacity range to fit virtually any requirement. As needs increase, add more sections.

There are many other advantages built into the DUALAIRE. *For further details send for this descriptive 12 page booklet. Or contact your nearest Western Precipitation representative!*

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Alberta *(Continued)*

Alberta government officials said the application will be considered as soon as possible.

Combined Developments, an Edmonton based firm, reports good lithium prospects for its Herb Lake claims in north-central Manitoba.

T. W. Connell, secretary, said prospective tonnage of lithium is rapidly being built up by the diamond drilling program and that production plans are in progress.

The official added that negotiations are being projected with a number of interested metal and chemical companies in the United States and overseas in this regard.

Indicated length of the lithium-bearing dyke at present has reached 1400 ft—with both ends open. A substantial amount of drill core awaits transportation for assay.

Early assays indicated values over 1%—which is considered commercial.

BRITISH COLUMBIA

Vast Frobisher-Ventures $700-million hydro-electric and metallurgical project which was to have changed the entire map of northern British Columbia, has been whittled down, for the time being at least, to a $50-million power development, as a result of international and Dominion-provincial power export hassles.

Originally, Frobisher Ltd. (a subsidiary of Ventures Ltd.) undertook to back another subsidiary group known as Northwest Power Industries Ltd., in the northern project, $270-million of which was to have been spent in developing 4.3-million hp of electricity by harnessing the water-power of the Yukon River's intricate system of inland waters lacing the B. C.-Yukon border.

B. C. and Yukon Chamber of Mines has asked the Gordon Economic Commission to recommend to the Federal government that conferences be held with United States towards establishing "corridors" through the Alaska Panhandle to the northern interior to facilitate development of mineral resources in northern British Columbia.

The Chamber claimed that the existence of the strip of land covering the northern coastline of B. C. "will result in a more aggravated situation as the north country develops" in so far as mining is concerned.

"Corridors through the Alaska Panhandle must be established if we are to bring about full development of mineral and other resources in the northern areas," the Chamber statement said.

British Columbia showed the largest gains in production of Canada's silver during 1954 to increase the national total by 5% over the preceding year.

Department of Mines and Technical Surveys' report says the 1954 production was 10% below record production of 1910.

Canada produced 29,711,805 oz silver of which B. C. mines produced 10,149,901. Values were $24,711,049 and $8,450,808 respectively.

Consolidated Mining and Smelting Co. of Canada Ltd. headed the producers with 11,901,184 oz but this was down from the 1953 production of 16,144,891. Much of this output is from custom ores and concentrates shipped to the Trail smelter, some from outside the province.

Torbit Silver Mines Ltd., near Alice Arm in the Cassiar district showed a gain over 1953. This is one of the few mines in Canada worked primarily for the silver content of the ore, with lead as a by-product.

Other important silver producers were Silver Standard Mines Ltd., near Hazelton; Highland-Bell Ltd. at Beaverdell; Violamac Mines Ltd. in the Slocan district and Sunshine Lardeau Mines Ltd. at Camborne.

In the Yukon, United Keno Hill Mines Ltd. in the Mayo district was Canada's largest single source of silver, with over 6-million oz in lead and zinc concentrates and silver precipitates.

Mackeno Mines Ltd., Mayo district, produced over 1-million ounces of silver.

Latest reports from Bethlehem Copper Corp.'s Highland Valley operation reveal the first diamond drill hole was still in

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	% RETAINED	% PASSING
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50M	63.2	36.8
100M	89.6	10.4
200M	97.7	2.3

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- high strength properties with low coefficient of expansion, excellent resistance to wear, and resistance to surface breakdown, assure long wearing life.
- its strength and toughness eliminate danger of cracks in mill heads.

The outstanding service performance of Meehanite, since 1937, has proved its ability to give long, trouble-free service...and is one of many important Marcy features which reduce milling costs.

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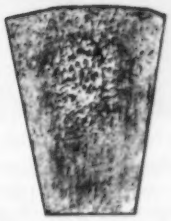
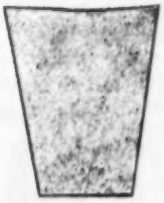
STEEL . . .
marked liquid contraction causes shrink voids, porosity and cracks.



CAST IRON . . .
slight liquid expansion causes porosity and voids.



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provides uniform solidity; permits designing and pouring castings that will have the desired strength and functional properties, free from casting strains.

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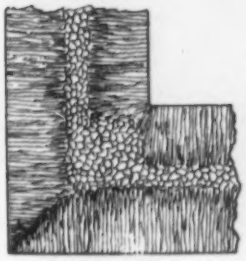
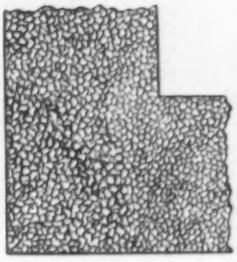


STEEL . . .
the junction of columnar crystals causes weakness in steel.



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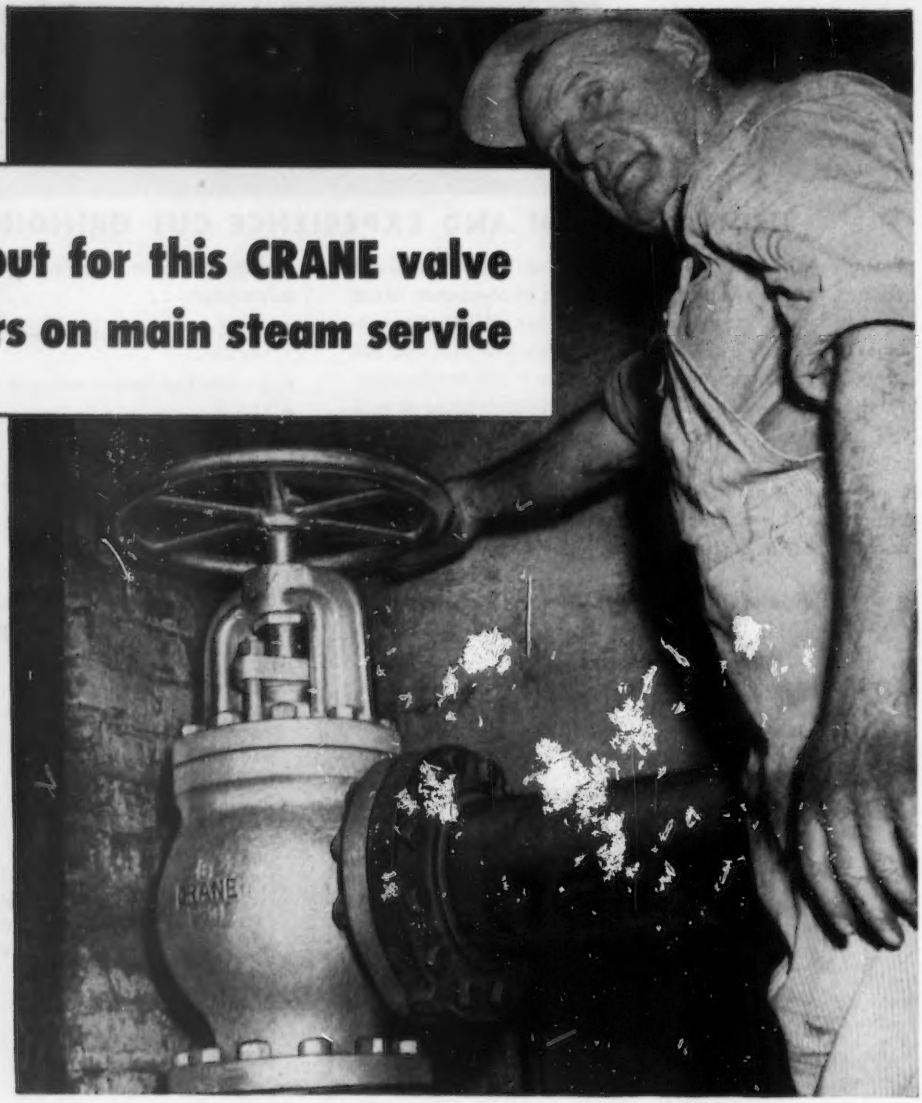

THE CASE HISTORY—Two Crane 250-pound iron body angle valves—6-inch (shown) and 5-inch size—scored this exceptional service record.

They were installed in 1915 on the main steam leads from boilers in the plant at Delavan, Wis., now occupied by The George W. Borg Corporation. In 40 years' uninterrupted service these Crane valves never failed to operate properly nor caused a shutdown. With but routine maintenance, they opened fully and were seated tight with ease under infrequent operation. Working pressure of boilers was originally 150 psi.—later reduced to 75 psi. This year, both valves were retired. The new replacements are Crane quality valves, of course.

Crane iron valves in particular need no introduction to thrifty buyers. In all grades, Crane iron castings generously exceed the requirements of equivalent A.S.T.M. specifications. Crane Ferrosteel, for instance, used in 250-pound valves is 35% stronger than ordinary cast iron.

In any pressure class, you'll find Crane quality outstanding. Choose from complete lines of gates, globes, angles and checks.

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British Columbia *(Continued)*

mineralization at 475 ft.

American Smelting and Refining Co. has two heavy drilling rigs at work on the depth exploration it is carrying out. (Under AS&R has an option on a 55% interest in net profits earned from the operations in return for placing the property in production.)

AS&R has decided to carry this hole down at least to 600 ft, which is 200 ft greater than the minimum depth called for in the agreement between the two companies.

Bethlehem president H. H. Heustis reported in Vancouver that core recovery of 80% is being obtained.

The second drill is testing the same zone about 300 ft distance from the first. Both are investigating at depth the extensive Iona mineralized zone.

The work to date has indicated 150,000 tons per vertical ft, having an overall grade of 0.64% copper.

Plans call for a continuous program through the winter, and Heustis says that in his opinion if early indications are proved by drilling now under way the property may rank with some of the major open-pit copper mines in North America.

Jackson Basin Mining Co. is reorganizing to bring its Highland Valley property into production, and shareholders this month will vote on a proposal to form a new company to be known as Jackson Mining Co., on a share basis of three shares of old for each one of the new issue.

As soon as the head frame on its Transvaal property is completed, McClellan says the company will launch a 2,000-ft under-ground development program. The 225-ft deep shaft on the property has been dewatered and reinforced.

Jackson Basin is reported to have $225,000 worth of equipment on the property now. McClellan says the operation will be working on a budget of $15,000 to $20,000 a month and between now and spring will put an extra $25,000 to $30,000 into capital expenditures.

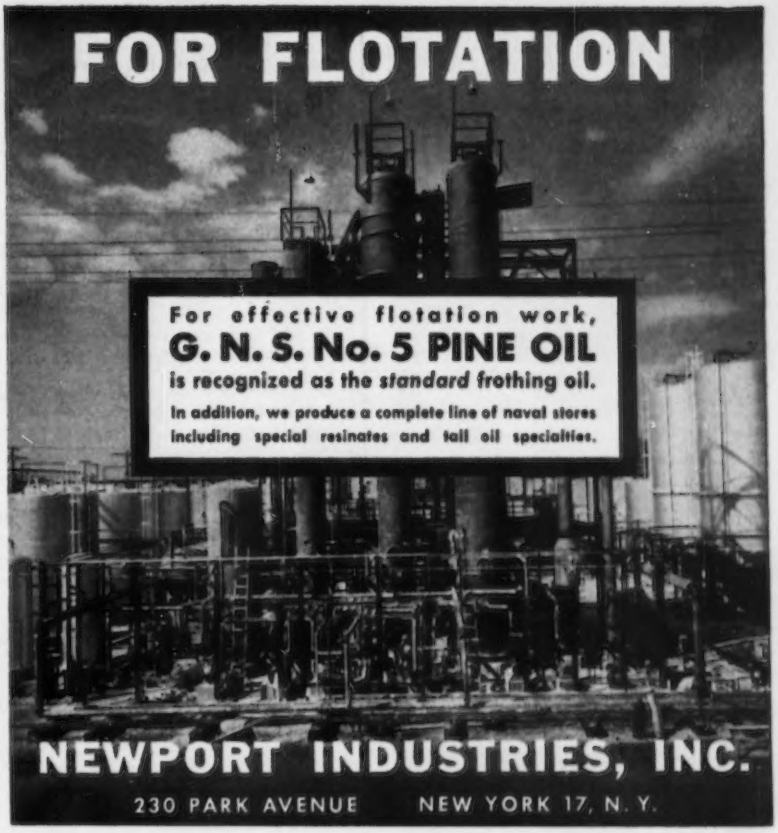
Standard Ore & Alloys, a New York production and marketing firm, is studying potential of United Estella Mines Ltd. lead-zinc mine at Wasa in the East Kootenay Valley, and have arranged to send an engineer to examine the property.

This examination is in connection with interest being shown by the large operating company in the possibility of investing in Estella Mines shares in a substantial way, officials report.

United Estella officials report the program to develop new underground ore reserves is proceeding on three fronts. A raise from the 6000-ft level has advanced 50 ft in continuous high-grade ore, they said. Two crews are working on this raise and two more are continuing a raise above the 6250-ft level to open up high-grade exposed on one of the old shafts from the surface.

Diamond drilling is in progress from a crosscut on the drive being pushed into a new ore zone on the 6000-ft level.

Diamond drilling on their new base metal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British Columbia *(Continued)*

property near Kamloops is under way according to Ormsley Mines and Goldcrest Mines who hold the prospect jointly.

The property comprises 24 claims and contains several gossan outdrops. Two shallow rock trenches about 700 ft apart exposed a width of 38 ft of mineralized diorite with no walls showing.

Eight heavily mineralized veins are reported with sampling of three veins assaying 1% copper, 1.5% lead and 7% zinc.

In addition there is average content of $6 gross per ton in silver and cobalt.

Rich gold-copper drill core showings at the Velvet Mine at Rossland have led Mid-West Copper and Uranium Mines Ltd. to install an auxiliary crushing unit to increase the mine's milling capacity to 100 tpd.

It will produce a bulk concentrate of gold-copper, one which in turn can be put through the flotation unit so that high-grade copper concentrate can be shipped to Tacoma smelter and leave the gold for shipment to Trail.

This will enable the company to process approximately 4 months continuous supply of ore from the dump while further ore is being developed from the extensive underground workings.

NEW BRUNSWICK

Croinor Pershing Mines is drawing up plans for a work program on its recently acquired 48-claim base metal prospect in the North Bathurst district. The group, adjoining holdings of Kennecott Copper Corp. and Stratmat Ltd., covers part of a large anomalous area outlined by air-borne survey.

ONTARIO

Wright-Hargreaves Mines, veteran gold producer in the Kirkland Lake area, is deepening its No. 5 internal shaft from the 7200-ft horizon to 7900 ft. The program follows encouraging drilling results at depth and successful deep work at the adjoining Lake Shore Mines. Completion of the program will make the mine workings the second deepest in North America.

An intensive diamond drilling program, using four machines, is being carried out by Halo Uranium Mines on what appears to be a promising new uranium ore zone in the northwestern section of the company's 1,750-acre property in the Wilberforce-Bancroft area. Drilling to date has secured some of the most promising intersections yet obtained in the area. Concurrent with drilling, underground development is to be undertaken from an audit already started.

A new copper discovery has been made by Noranda Mines on the west shore of Eagle Rock Lake, some 15 miles west of the Temagami Mining Company's property at Lake Temagami. The company staked 38 claims covering the discovery site and a second group of nine claims further to the south. Ground in the immediate area was quickly blanketed as a staking rush developed. The area is described as showing widespread gossan and initial sampling in one sector has returned values in copper, cobalt, lead and zinc.

International Nickel Company of Canada, the world's largest nickel producer, has commenced trial operation of equipment in the first unit of the company's iron ore plant near Copper Cliff. Built at a cost of $19-million, this first unit will treat 1,000 tons of pyrrhotite concentrate daily. After operation at full capacity, expansion is planned to permit an ultimate annual output of about 1-million tons of iron ore. This ore, higher in grade than any now produced in quantity in North America, will contain more than 65% iron and less than 2.0% silica.

Concentrating unit of Beacage Mines' pilot mill at the columbium-uranium property, Lake Nipissing, a few miles from North Bay, is now in operation. Concentrates are being stored for treatment in the leaching section, which is expected to be completed late this winter or early spring. Premium grade columbium oxide and high grade uranium oxide will be the two main end products of the completed plant, while titanium and silicon will be produced as by-products.

An entirely new zone is being tested by diamond drilling by Consolidated Sudbury Basin Mines at its large base metals property in the Sudbury area. Preliminary results have given ore values in copper, lead and zinc. The zone is located about 3000 ft northeast of the No. 3 Errington shaft and some 1500 ft northeast of the drilled section north of this shaft where good diamond drill results were obtained.

A renewed diamond drilling program, expected to extend well into the winter, has been initiated by Algoma Ore Properties Limited at its Calabogie magnetite property near Ottawa. The original drilling outlined a sizable orebody to depth of 1000 ft and present work will test for extension of the ore at the 2000-ft horizon. Initial results indicate average ore widths with grade equal, if not better, than at the 1000-ft horizon.

Tonnage being treated at the Pronto Uranium Mines' Blind River area plant is being increased steadily and it was anticipated that the rated capacity of 1250 tons per day will be reached before the New Year. Shipments from Pronto, the first producer of uranium precipitates in the Blind River area, started Nov. 1 and are being continued on a two-weekly basis. Grade of final product is considerably higher than specifications. Grade of ore, operating costs and mine developments are all up to expectations.

An all-out program to prove up sufficient uranium ore to qualify for a government premium price contract prior to the March 1956 deadline is under way at the Haliburton-Bancroft area property of

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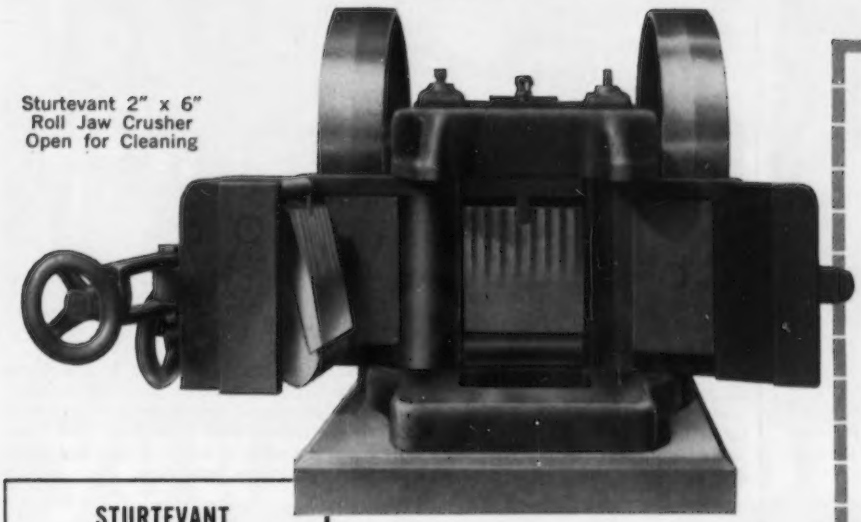

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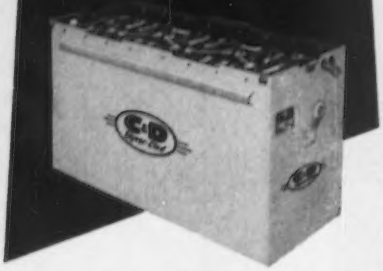

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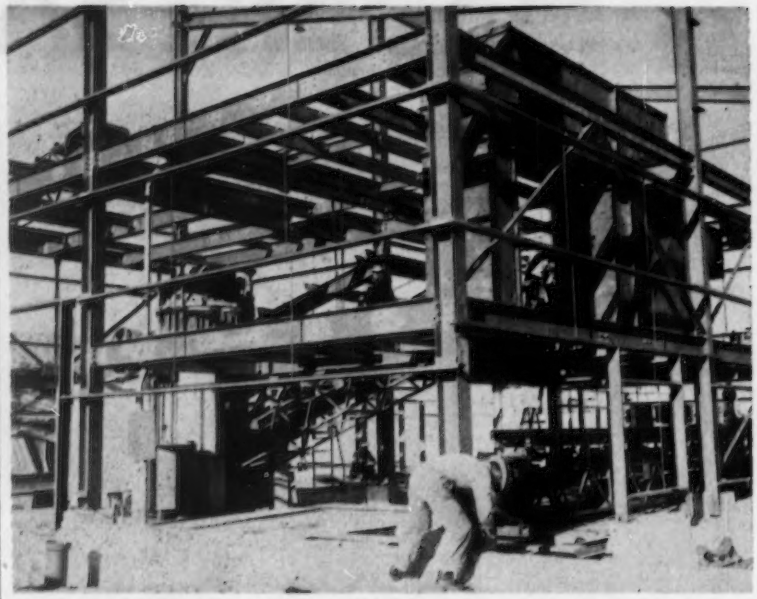

WORKING TOWARD AN EARLY APRIL on stream date, Rare Metals Corp. of America, Tuba City, Ariz. is putting the finishing touches on their uranium resin-in-pulp concentrator. Secondary crusher (above), primary crusher and mill house are well on the way. Sampler and buying station were opened on Dec. 15th. More than 8,000 tons ore have been stockpiled, according to M. H. Kline, vice president and general manager of the El Paso Natural Gas Co. subsidiary.

ONTARIO *(Continued)*

Rare Earth Corp. of Canada. Underground work is progressing from two separate shafts and two adits, while five machines are being used in diamond drilling. The immediate objective is to prove up 2-million tons. Overall grade is expected to work out at about 0.10% uranium oxide and mill tests have indicated a 92% recovery.

QUEBEC

The smelter at the large Gaspe Copper Mines' operation in the Gaspe area was expected to be in operation before the New Year. Production aim is around 100 tons of copper per day or about 70-million lb per year. The first concentrator unit is now up to 3000 tpd. Most of the concentrates are being stockpiled at the mine and there is about 6000 tons on hand ahead of the smelter. The second concentrator unit, when put into operation, will bring total capacity to 6500 tons per day.

Stripping and shallow diamond drilling at the Dore Lake property of Quebec Chibougamau Goldfields in the Chibougamau area have disclosed a shoot 350 ft long, 16 ft wide, with a copper content of better than 3.5%. The shoot occurs within a structure traced on surface for a length of 3400 ft across widths of from 20-80 ft. Drilling operations are being continued with three rigs.

Ore reserves at the property of Weedon Pyrite and Copper Corp. at Weedon, about 40 miles east of Sherbrooke, are estimated at 401,000 tons averaging 2.25% copper to slope depth of 300 ft below the 14 or bottom level. In addition contained pyrite is valued at about $3 per ton of ore. Plans have been made to open a new inclined shaft, which will provide three new levels below the 14.

A new molybdic oxide producing plant is currently under construction at the property of Molybdenite Corporation of Canada in the Val d'Or area. The plant is expected to be completed within four to six months. Company, the sole Canadian producer of molybdenite concentrates, is making further increase in mill capacity from 515 to 600 tpd.

MANITOBA

Provincial minister of mines and mineral resources predicted that this year's output of metallic minerals in the province will be 82% above 1954 values.

The minister, C. E. Greenlay said the output will probably reach $36-million in value, mainly due to the new copper-nickel production at Lynn Lake as well as to the increased price of copper.

A mineral-staking boom in the province this year had seen 8,400 claims staked up to the end of October, compared with 3,000 in the same period of 1954.

One particularly bright spot in the exploration field was lithium in the Cat Lake area. Two mining firms are getting ready to sink shafts there and begin production, while the provincial government undertook to build roads into the lithium mine camps.

Do you save money when you by-pass your distributor?

Offhand . . . you might say you save money when you buy direct from manufacturers.

Experienced purchasing men would tell you that this kind of "bargain" is heavily booby-trapped, that low prices at the expense of your local distributor are often very costly to the buyer.

Sure, it's great at first . . . buying major items direct from the maker. But direct buying has a way of snowballing . . . the buyer finds himself in a widening spiral that includes the direct buying of more and more items . . . and then they're anything but bargains. For the savings effected by direct buying are more than swallowed up by extra man-hours needed to handle the volume of paper work it entails, to say nothing of extra shipping costs and warehousing expenses. Add to that the loss of the competent on-the-spot advisory service your local distributor gives you, and you'll agree that it would take far more than the modest saving you'd realize to compensate for the total cost of such purchasing.

We are convinced that it is advantageous to *both* the buyer and seller to have products go through a distributor. By minimizing the manufacturer's sales and distribution costs, by providing a "department-store for industry" to supply *all* purchasers, by giving services that only a local organization can provide efficiently, we are convinced that today's distribution pattern—from maker to local distributor to user—is the most effective and economical it is possible to devise.

3594

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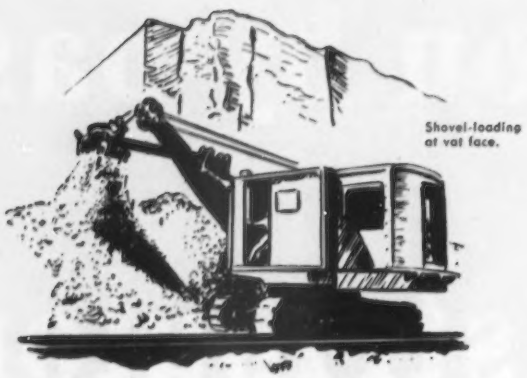

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- **MOSS BLUFF, TEXAS**
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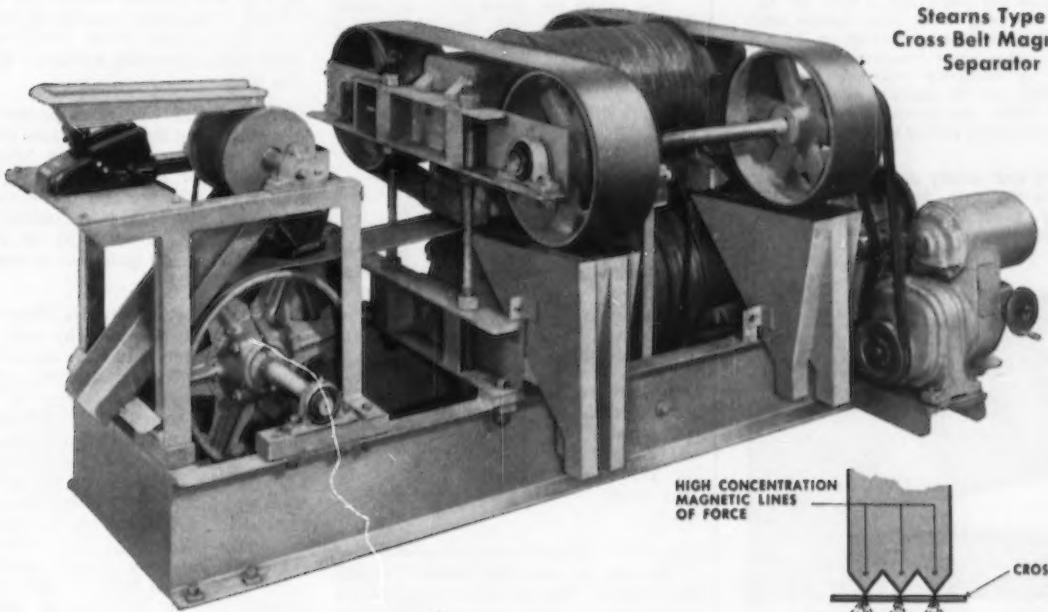
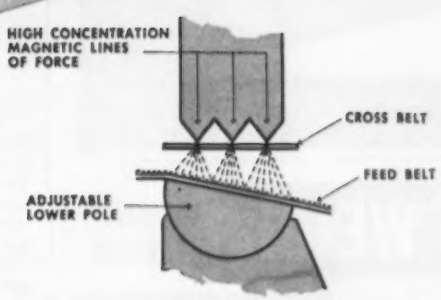
Stearns make two magnets do the work of five in strategic ore separation



Stearns Type R
Cross Belt Magnetic
Separator



Equipped with exclusive, patented variable pitch lower pole, the Stearns cross-belt magnetic separator does more work, faster and at lower cost than comparable units of greater size. It provides amazing control in separating weakly magnetic ores in both placer and hard rock deposits — monazite, wolframite, huebnerite, ferberite, columbite, tantalite and ilmenite. Other special features include:

1. Individual, independent variable speed drives for both cross belts and feed belt . . . an exclusive Stearns feature.
2. Separator is furnished with an electric control panel with rheostat and ammeter to adjust strength of magnet.
3. Design of unit permits closed magnetic circuit — magnetic intensity is utilized at exactly the desired points.
4. All points in each magnetic field are of the same polarity. This, plus the fact that the mineral grain is entering successive points of increasing magnetic intensity, because of the adjustable lower pole, helps to overcome magnetic reluctance in weakly responsive materials.

Stearns maintains a fully equipped laboratory for thoroughly analyzing and testing ore samples. This, plus Stearns' wide experience in the magnetic separation field, assures you of getting exactly the right unit for your needs. Ore samples for analysis or requests for information receive immediate attention. Write today.

Exclusive variable pitch lower pole.

Simply by varying the pitch of the lower pole piece you can vary the air gap between the upper and lower poles to increase or decrease strength of magnetic lines of force at each point. This enables very selective extraction of distinct magnetic products at each point. The most magnetically responsive ore will be separated at the first or wide gap point. As the air gaps get smaller the magnetically weaker ores are extracted and carried off on the bottom side of the cross belt. Non-magnetic material is carried off on the feed belt.

With this variable pitch lower pole, as many as one non-magnetic and ten magnetic products can be obtained from just two magnets. *To do this same job on ordinary separators would require five magnets, take up much more floor space and cost approximately twice as much.*

MAGNETIC EQUIPMENT FOR ALL INDUSTRY

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BELT FASTENER No. 500

FOR HEAVY CONVEYOR BELTS OF CHANGING LENGTH

These heavy-duty belt fasteners make a strong, flexible joint in conveyor belts, belts of any width and of from 3/16" to 1/2" thickness. They offer special advantages in mines, quarries or industrial setups where length or position of belt is frequently changed, because sections can be removed or added at will. Joints are opened for this purpose by simply pulling out the hinge pin.

Easily and quickly applied on the job or in the shop. Special design gives deep compression into belting and smooth, flush joint.

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WEIGH WITHOUT STOPPING
WHILE YOU **CONVEY**

Yes, weigh and record with the —MERRICK

WEIGHTOMETER

The Merrick Weightometer provides a continuous, automatic, accurate weight record at any designated point in the mill, while material is in motion on conveyor. It weighs without interrupting conveyor service. Applicable to any size belt conveyor, horizontal or inclined. An accurate and dependable means of keeping constant check on production.

MERRICK SCALE MFG. CO. PASSAIC N. J.

Manitoba *(Continued)*

A major copper-nickel ore with a deposit of about 1.5-million tons has been discovered in Manitoba by the Eco Exploration Co. Diamond drilling on the site, which is in the Cat Lake area, indicated that the ore deposits are about 900 ft long, and run to widths of as much as 100 to 125 ft.

The values are about .69% for nickel and 1.22% for copper. The discovery is only 9 miles from power lines and 4 miles from a road. The land is owned by the Manitoba Gold Mines Ltd. which expect to begin mining operations by this month.

IN AUSTRALIA

Preliminary but highly reliable estimates for Australian mining production in 1955 indicate increases for copper, tin, rutile, zirconium and tungsten but decreases for antimony, lead and zinc. All comparisons are with 1954.

Production of zircon to June 1955 was 25,070 tons but according to the Bureau of Mineral Resources "indications are that the production of zircon concentrates in 1955 will considerably exceed the record of 42,410 tons established in 1951."

Domestic Australian production of blister copper for the first eight months of 1955 was 28,569 tons corresponding to an annual production rate of 43,000 tons. Production in 1954 was only 39,000 tons. Production from Mt. Isa (associate of American Smelting & Refining Co.) has increased to an annual rate of about 23,000 tons. Refined copper for the period was at the annual rate of 36,000 tons, a figure considerably in excess of 1954 figures.

Refined tin output to September was 1,572 tons and the mine output of tin in concentrates was roughly the same as in 1954. Great hopes for production additions from Shaw River Alluvials remain to be fulfilled. Northern Mineral Syndicate is opening up tin leases east of the Shaw River. Tin & Strategic Minerals which is working Western Australian shallow alluvial, was considerably hindered by exceptional rains. The Dorset Tin Dredge has now resumed production.

Considerable interest continues to be shown in the production of rutile concentrates. Heavy overseas demand was responsible for the jump in output in the first six months of 1955. Production rose from 18,575 tons to 25,730 tons. The total 1954 output of 44,659 tons is likely to be exceeded in 1955 by at least 25 to 30%. Further marked increases are confidently expected and expansion projects, including the recently reported Western Titanium N. L. in Western Australia, may increase Australian output to figures considerably in excess of present figures.

Stability in prices for wolfram and scheelite concentrates has resulted in the recurrence of interest in these materials with many small producers, particularly in Northern Territory and Queensland, reopening their mines. Output figures are understood to exceed those for 1954.

Australian output of refined zinc was affected by the power shortage in the Risdon area and is below 1954 figures. Mine output of zinc for 1955 is expected to be in the vicinity of 265,000 tons. Refined lead output for first seven months of 1955 was 123,661 tons and of bullion 27,600 tons. Mine output of lead for 1955 is expected to be lower than in 1954 and is currently estimated at 295,000 tons.

Output of antimony in antimony ore is also running at levels lower than in 1954. The New England Antimony Mines has resumed after the reconstruction of its mill but results are still below expectations with the grade of ore mined being only 50% of the published ore reserve grade. Very small quantities of ore came from Queensland.

Ore treated by the Mt. Isa Mines in its last fiscal year increased by only 2.7% to 1,244,192 tons but higher copper prices lifted sales by 30% to a record £A13.8-million. Mining expenses rose by about 15% and tax provision by 80%. Depreciation provisions were unchanged and the net profit was a record £A3.3-million against £A2.1-million in the previous fiscal year. £A1-billion was earmarked for capital expenditure and development next year. Assets of this American-controlled company exceed now $40-million. Estimated lead-zinc ore reserves are 12.2-million tons against previous year's 9.9-million tons and copper ore reserves rose by 1.4-million tons to 5.1-million tons.

Tasmanian Government is trying to interest American, British and German firms in the huge deposits of iron ore. The deposits are located on the northwest coast of the island and aerial surveys are being undertaken to obtain sufficient data for a large-scale boring campaign.

United Uranium N.L.'s No. 1 shaft at the El Sharana lease is in high grade pitchblende from 57 to 62 ft. Crosscutting at the 57 ft level showed a lode of 36 ft wide assaying 1.2% uranium oxide. Average assay after driving along the lode for 38 ft was 0.91%.

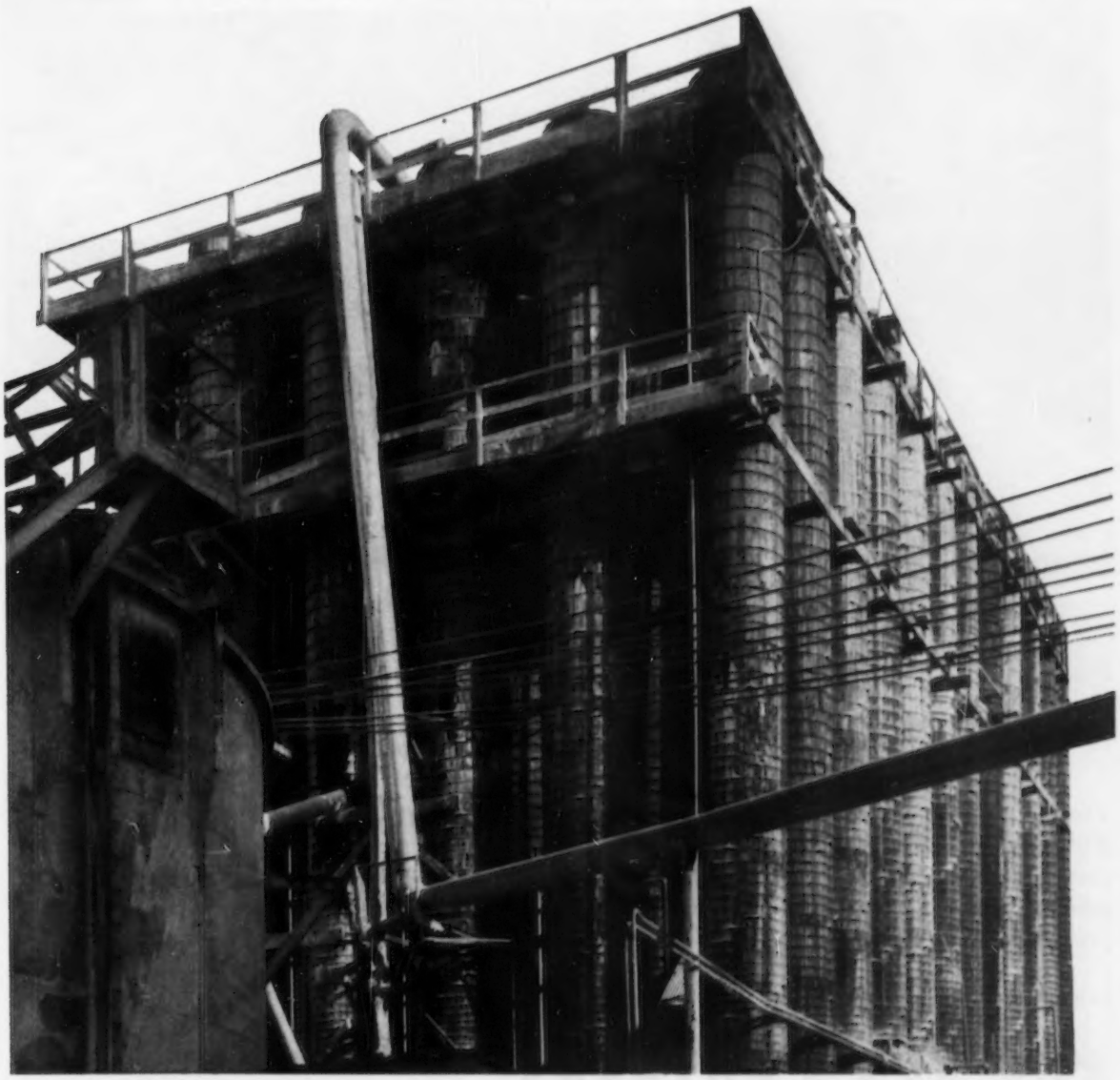
Australia's Bell Bay aluminium plant is expected to reach an output of 10,000 tons annually in 1956 on a designed capacity of 13,000 tons but yearly domestic consumption has already outstripped this last figure, according to the Department of National Development. Imports of aluminum ingots in the first six months of the year were 6,965 tons and in addition, considerable amounts of fabricated products were imported.

Western Uranium reported that drill hole ES-10 at Ravensthorpe in Western Australia has indicated 40 ft true width ore averaging 1.6% copper at 1,150 ft vertical depth. Hole E-14 has proved a true width of 11 ft ore averaging 5% copper at 250 ft.

Good grade ore has been located by Montana Silver Lead N.L. at the 150-ft level.

about satisfying details in soda ash orders . . .

When you write your requirements as to shipping date, routing, acknowledgments and advices into an order, we know you do it for a reason . . . and that's reason enough for us to pay the very closest attention to every detail. We consider it our responsibility to fill orders exactly as written.



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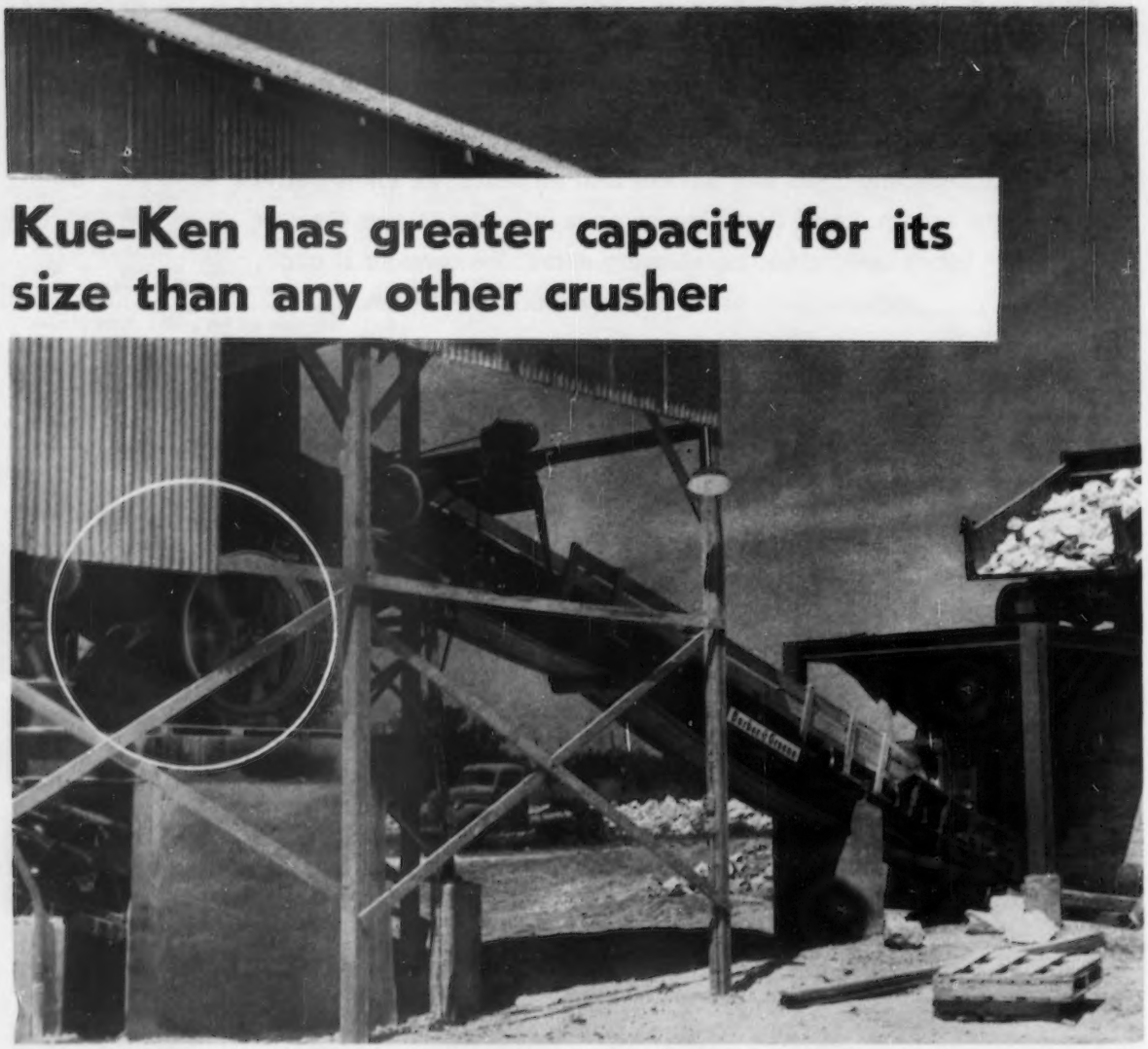
SODA ASH • BORAX • SODIUM SULFATE • SALT CAKE • HYDRATED LIME

EXECUTIVE OFFICES, 1956 WEBSTER, OAKLAND 12, CALIFORNIA • PLANT, WESTEND, CALIFORNIA

Kue-Ken has greater capacity for its size than any other crusher



New crushing plant with 36" x 12" Kue-Ken jaw crusher (1½" product) and 36" Kue-Ken fine bowl gyratory crusher (minus ¼" product). 7 other Kue-Ken crushers have been producing profitably for this company for many years.

The far higher capacities of Kue-Ken Crushers often permit you to use a smaller size crusher than you ordinarily would and thereby save considerably in initial cost. Kue-Ken operates inexpensively. Jaw plates outlast those of other crushers 5 to 10 times, power consumption is far less, breakage from overload is eliminated by automatic flywheel release that is quickly reset. Filtered oil lubricates the mechanism in a sealed, dust-tight crankcase to prevent wear.

KUE-KEN CRUSHERS

"LOWEST COST-PER-TON CRUSHING"

Jaw Crushers Gyratory Crushers Overhead Eccentric Crushers Revolving Screens
Classifiers Feeders Rib Cone Ball Mills Concentrating Tables Vibrating Screens

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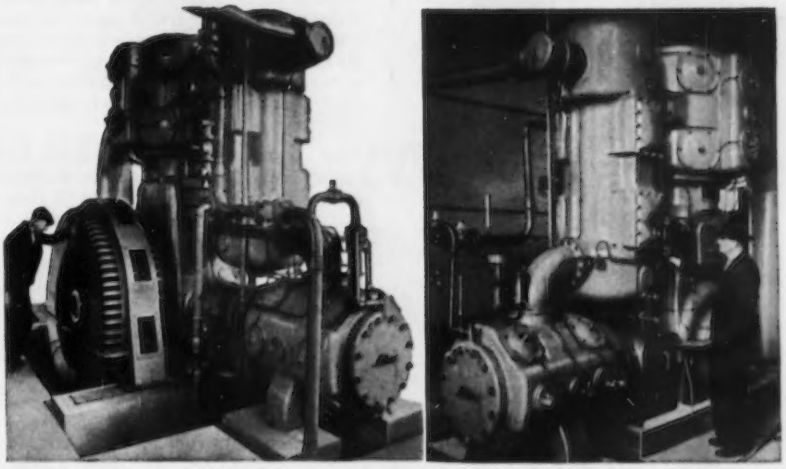
Pennsylvania Crusher Division, Exclusive Licensed Eastern Manufacturer and Distributor, 323 S. Matlack St., West Chester, Penn.
Armstrong Whitworth (Metal Industries) Ltd., Authorized Licensed Manufacturer and Distributor, Close Works, Gateshead-upon-Tyne 8, England

Atlas Copco AR type Compressors give *more* air to the h.p. than other machines of their class

Choose a rugged Atlas Copco AR Compressor and you can rely on it to deliver more air, h.p. for h.p., than any other compressor of its class. The reason is that these machines have been developed with the aim of low operational costs—both in fuel and upkeep. Take the AR 3 mentioned below. Its power consumption at 100 lbs. per sq. in. is 105 h.p. With this power consumption the supply of free air is 570 cu. ft. per min. Compare performances!



An Atlas Copco AR9 Compressor installed at N.C.B. Mountain Colliery, S. Wales

The photographs in this advertisement are published with the permission of the National Coal Board

FUEL SAVING PAYS FOR OUTLAY

To get the same amount of air from other compressors would, in most instances, require an additional 15 h.p., but 15 h.p. never used mean an *annual saving on fuel bills of £270*. That amount of money represents approximately *one-fifth* of the initial cost of the AR 3. In five years, that's your money back!

FLEXIBLE AIR SUPPLY

Three-step valve unloading control on smaller models or five-step clearance pocket control on larger sizes permits flexible adaptation to variations in air demand. Also means smooth flow of current to motor.

LOW DISCHARGE TEMPERATURES

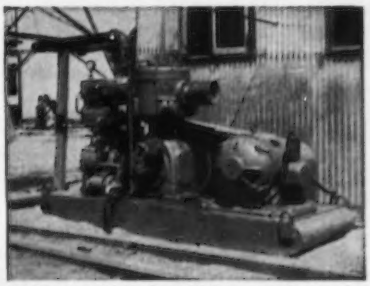
Amply-dimensioned water pockets, the two-stage design and streamlined air passages give discharge temperatures below 270°F at 100 lbs. per sq. in.—as compared with 475°F from most single-stage machines. Lower temperatures mean longer valve life and elimination of the risk of air receiver and pipe-line explosions.

EXTRA-SOLID CONSTRUCTION

High-class Swedish materials and steel throughout; amply-dimensioned parts reduce stresses to a minimum; crankshafts carried on SKF roller bearings; cross-head design with ground or white-metal lined bearings avoids piston side pressure, eliminates cylinder wear.

EASE OF INSTALLATION

Right-angled, double-acting cylinders combined with counterweighted crankshaft provide a very low weight/capacity ratio and extremely good balancing—thus reducing foundation requirements. So good indeed, that most models can be mounted on a skid underframe and used as semi-portable units without any foundation or bolting-down.



A skid-mounted Atlas Copco AR Compressor in operation at Pima Mining Co., Arizona, U.S.A.

The Atlas Copco Group puts compressed air to work for the world. It embraces thirty-one Atlas Copco companies and twenty-four agents, manufacturing or selling and servicing Atlas Copco equipment in more than 50 countries throughout the world.

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Readers in countries outside those listed above and who do not know the name of their local Atlas Copco company or agent, please write to Atlas Copco AB, Stockholm 1, Sweden.

Please forward details of **Atlas Copco AR type Compressors.**

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COMPANY _____

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*I am also interested in other Atlas Copco equipment (*please state which below*).

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PERFORMANCE FIGURES OF ATLAS COPCO AR COMPRESSORS

Type	Maximum pressure lb./sq. in.	Speed at 50 cycles r.p.m.	Low-pressure piston displacement cu. ft. min.	Free air delivery at 100 lbs. sq. in. cu. ft. min.	Power required at 100 lbs. sq. in. h.p.	Cooling water required at 60° F approx. gal./hr.	Weight lbs.
AR 1	120	600	404	330	62	310	2860
AR 3	120	500	718	570	105	506	5280
AR 4	120	429	915	760	138	682	5610
AR 5	120	375	1230	1000	185	880	9020
AR 7	120	333	2120	1750	320	1540	14520
AR 9	120	300	4020	3220	587	2926	26400

* *Manufacturers of Stationary and Portable Compressors, Rock-drilling Equipment, Loaders, Pneumatic Tools and Paint-spraying Equipment.*

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Any Type
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A Riblet Aerial Tramway will carry your ore, concentrates, coal or waste over any terrain economically and dependably.

Low cost per ton through any weather with a Riblet Automatic System.

Consult versatile specialized designers of Aerial Tramways.

RIBLET TRAMWAY CO.
Box 7, Sta. A, Spokane, Washington
58 Years of Experience

Australia *(Continued)*

The orebody appears to have a known length of 100 ft and should lead to further development at the 200 ft level. Indications of copper-nickel have been revealed by a geophysical survey of an area held by the company in virgin country about 7 miles from the main Montana mine. Results from diamond drilling were most encouraging and further diamond drilling was ordered.

Lead production is being stepped up rapidly at the Western Australian Kooline field, about 170 miles south east of Onslow. Ore extraction has already exceeded original estimates. The booming Western Australian lead output is going mostly to the United States and Japan.

IN AFRICA

Although sales of coal from the Wankie colliery totaled 3,414,719 tons against 2,732,957 last year, Copperbelt mines still have to burn "a lot of wood." Mines no longer import coal via Lobito Bay. Situation will continue until Rhodesian rail facilities are improved and Wankie completes a $17-million expansion plan to up productive capacity from 4½- to 5-million tons per year, sometime in the coming year.

Messina Development Co., Northern Transvaal, has applied for an exclusive prospecting reservation over some 50 square miles in the Salisbury district, Southern Rhodesia, to look for copper, lead, zinc and allied minerals.

Company already holds an order on an iron deposit in the area.

Rich samples of chrome (40 to 49% with chrome-iron ratio of 3.5 to 1) have been found in Zululand, northern Natal. Probable ore reserves are set at 156,000 tons, with a large disseminated orebody nearby not yet explored.

Mining consultants are of the opinion that ore can be upgraded to about 55%. One U. S. company reportedly has signed contracts for delivery of $1,680,000 worth of chrome annually.

Fourteen Transvaal and Orange Free State mines have worked more than 1-million shifts without a fatal accident, according to the president of that organization. The official spoke at ceremonies honoring overseer Johannes Serfontein, who broke through 5 ft of a rockfall to rescue a miner. Serfontein received the mining industry's Bronze Medal for Valour.

Volumes of water have delayed underground development of the Bancroft mine on the Northern Rhodesia Copperbelt. Surface construction, too, involves special attention to foundations due to poor bearing qualities of the ground.

Target date—January 1957—should not be altered greatly, but costs now are set at $5.6-million, needed between 1958 and 1960, including $1.4-million for deepening of the No. 1 shaft.

IN LATIN AMERICA

MEXICO

Maquinaria Minera e Industrial, S.A., announced completion of a 100 ton capacity flotation plant for Mina La Marina, Huitzuco, Guerrero. Huitzuco has been a mercury producer for many years with sporadic production paralleling the frequent rises and falls in the price of mercury. The mercury at Huitzuco occurs mostly in the form of livingstonite, a combined mercury and antimony sulphide in combination with cinnabar and stibnite.

Mill embodies a standard flowsheet with single stage crushing through a Rogers Jaw Crusher to an oversize 300 ton fine ore bin to give ample storage capacity. Ore is ground in a standard ball mill classifier grinding circuit and the combined mercury-antimony concentrate is then floated in a standard flotation circuit preceded by conditioning. Concentrates then pass to a thickener and drum filter for subsequent treatment.

The flotation plant will enable Mina La Marina to greatly increase capacity of raw ore handled. Prior to installation of the plant, only high grade ore was burned in "Mexican" furnaces consisting of 8 in. iron pipes heated by charcoal fire with the mercury passing to a condenser.

BOLIVIA

New tin reclamation plant at the nationalized mine at Catavi will begin operation this month, officials say. Plant, to reclaim some 135 tons of tin per month, is said to cost U. S. $500,000. Present output at Catavi is 703 tons, with an increase to 838 tons planned with completion of the new plant.

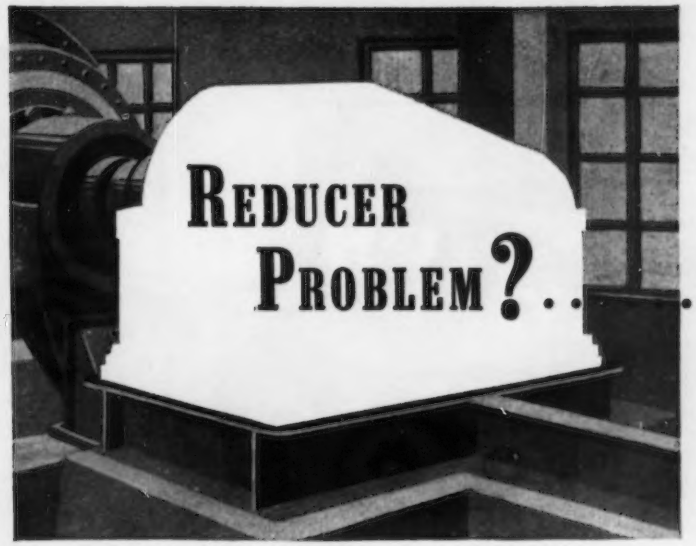
Ford, Bacon & Davis will "survey and study the Bolivian mining situation" and advise and assist the Bolivian Minstry of Mines in "a total readjustment of the present operative system, to increase to maximum the mining exploitation indexes."

Discovery of "rich manganese deposits near the Ocoro river" has been announced by a group of technicians who surveyed the fields at Itenez Province, Department of Beni.

According to the report grade "fluctuates" between 55- and 65% and water, land and hydroelectric power potential are favorable. Report noted that transportation costs would be high.

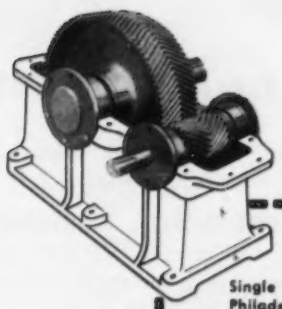
BRAZIL

Brazilian technician Arykoerner Guerreiro, of the Ministry of Agriculture, reports invention of a revolutionary

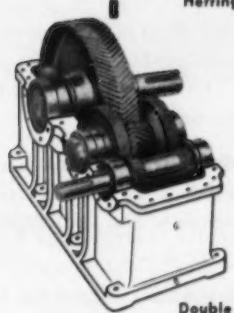


REDUCER PROBLEM?...

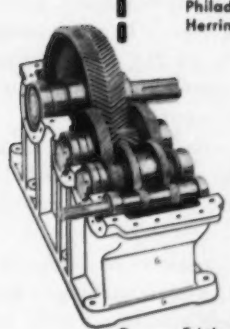
...*consult*



Single reduction
Philadelphia
Herringbone Reducer



Double reduction
Philadelphia
Herringbone Reducer



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Herringbone Reducer

If you have a problem involving high horsepower speed reduction with heavy shock loads, Philadelphia Herringbone Reducers are the answer. These quality-built units are available in Single, Double and Triple Reduction types, offering a wide selection of capacities and reduction ratios. The continuous tooth type herringbone gears assure evenly distributed pressure over each tooth from the top to the working depth line, — which means exceptionally long life, minimum vibration, quiet operation and maximum transmission of power . . . Thousands of Philadelphia Herringbone Reducers are in daily use, in most every line of industry. Be convinced, send for Catalog H-49.

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THE NEW ATHEY PR-15 REAR DUMP TRAILER

SPEEDS TO 31.3 MPH provide high production at the lowest possible cost. No idle shovels or wasted time. More loads per hour, more material hauled per day.

15.6 CU. YDS. (22 TON) CAPACITY — matched design of the tractor and trailer assures top performance — utilizes full tractor capabilities.

FAST 12 SECOND DUMPING keeps units producing — earning more money. Body raises 60° to dump any load quickly and surely. Spreading is easy with positive operator control of the dumping angle. High speed pump flow control valve and double-acting cylinders all team up to give maximum efficiency.

TURNS IN 37' — facilitates work in narrow cuts and speeds spotting under shovel. Keeps cycle on a profitable basis, eliminates high cost maneuvering.

POWERED BY CAT 186 HP DW15 TRACTOR and interchangeable with the No. 15 Cat Scraper. Tires on the tractor and trailer are interchangeable. Trailer tires, wheels and brake drums are also interchangeable with the No. 15 Scraper for greater economy.

HYDRAULICALLY-CONTROLLED THROUGHOUT — positive, dependable. One lever for dumping. No complicated cable arrangements or downtime for costly cable replacement.

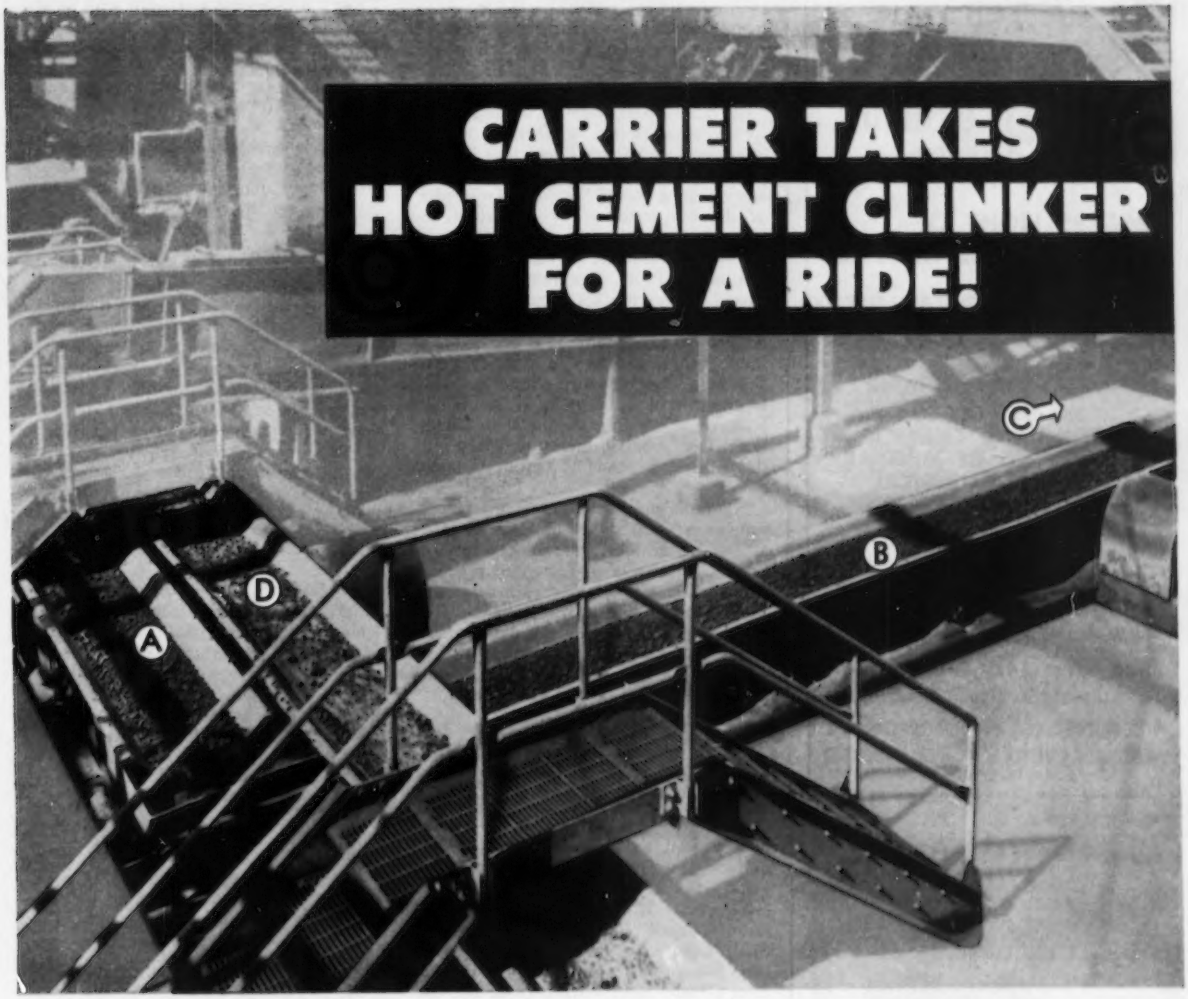
EXCELLENT WEIGHT DISTRIBUTION with 37% on the tractor drive wheels. Traction assured in the toughest footing with big 21:00-25, 24 ply rock-type tires on the trailer and tractor drive wheels.

RUGGED AND DEPENDABLE, made of premium quality steels by specialists in the tractor-trailer field. Over 32 years of know-how and field experience stand behind the PR15.

The PR15-DW15 team is designed for high production at the lowest cost. It has many advantages over other types of hauling units. The wide mouthed body is an easy target. A low loading height increases shovel efficiency. The low center of gravity permits maximum speeds on the haul and around tight turns.

Safety is built in with big powerful brakes. Positive operator control on the edge of the fill with independent braking of tractor drive and trailer wheels. Handling is easy and sure.

All these features mean more profit on every job where the PR15-DW15 team is working — loading more, rolling faster, dumping quicker. Check your Athey-Caterpillar Dealer for all the facts. Find out how you can cut your hauling cost with the new PR15. *Athey Products Corporation, 5631 West 65th Street, Chicago 38, Illinois.*



Carrier Conveyor "A" takes the clinker from coolers and feeds it at right angles onto the first of two other Carrier Conveyors "B" ("C" not shown) for delivery to a bucket elevator and storage.

Carrier Conveyor "D" also takes the clinker from coolers, but conveys it directly to a different storage pit.
All four conveyors have 18" flared pans and 5HP drives, with a total length of 233'.

THAT'S hot cement clinker you see on those four Carrier Natural-Frequency Conveyors. It's being taken for a ride from coolers to two different storage pits. . . .

400° F. clinker is extremely abrasive — extremely tough to handle. Yet the Carrier Natural-Frequency Conveyors move it at the rate of 60 tons per hour with *a minimum of spillage, maintenance and downtime!*

Cement-industry applications are just one of many uses for Natural-Frequency Conveyors. Others include bulk chemicals, castings, ores, mill scale and slag, food products, machine turnings — all of which are now being conveyed and processed with spectacular success by Carrier Natural-Frequency vibrating equipment. Write for Bulletin 111. Carrier Conveyor Corporation, 247 North Jackson Street, Louisville 2, Kentucky.

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Brazil *(Continued)*

metallurgical process for obtaining nickel with much less labor and electric power, making it therefore economically advantageous. Brazil still does not produce pure nickel, and depends on imports to supply the domestic market. In a press interview, the scientist said that his new process is hydroelectric-metallurgical, and is based on the "molucular disorder" of the ore followed by lixiviation and electrolysis.

"The manufacture of nickel in Brazil," continued Prof. Guerreiro, "has not passed the ferronickel stage. We produce this alloy exclusively as pure metal, since the apparent consumption is of 1,100 tons for the production of 220 tons. Purchases abroad fell off recently with the closing of the American market, as the United States is stockpiling the metal in a large scale. Our country, therefore, faced with this problem, had to produce much more."

National production of alloy is subject to the availability of electric power at low price. The process developed by Prof. Guerreiro is characterized precisely by the consumption of very little power. To obtain one ton of iron-nickel by present methods 15,000 kw are used, whereas by the new process 6,000 kw will be sufficient to get one ton of the pure metal.

CHILE

Cia. Minera Condoriaco, owner of the well known gold-silver camps of Condoriaco and Quitana is getting ready to work again at its 40 tpd cyanide mill at Condoriaco, 12 miles east of Almirante Latorre depot on the Longitudinal Railroad, Coquimbo province. The ore in situ, fillings and dumps in Condoriaco have already been worked twice but owing to the rise of silver in the internal market, where the metal is in great demand, it has become again a good proposition to rework over fillings and dumps.

The 30 tpd contact sulphuric acid plant which Corporación de Fomento (Chilean RFC) is building at the port of Antofagasta will be ready to operate by the end of January. Plant has been designed and is being built under the technical supervision of the German firm of Lurgi and will use Chilean brimstone obtained by the autoclave process as raw material. Operation of the plant is bound to give a good impetus to copper mining in Antofagasta province where oxidized copper ores similar in composition to those of Chuquicamata are plentiful and easily mined. Until now lack of a cheap source of sulphuric acid was acting as a brake on the development of many small and medium size deposits in this zone.

Next January Bethlehem Chile Iron Mines will start exploiting its new Romeral mine, north of La Serena. Mine will be open cast and ore will be shipped by rail to Guayacan Bay where a modern loading wharf has been built. Besides furnishing Bethlehem furnaces with high grade ore, Romeral will also supply Chile's Huachipato steel mill with all the iron ore it requires, about 500,000 tons per year. Romeral's grade is 60% iron, mostly hematite.

Satisfactory progress is being made in the construction of the first 300 tpd unit of La Africana copper flotation mill located near Santiago. La Africana is one of the two copper mines opened up more than 30 years ago by Santiago Mining Co., a subsidiary of Anaconda Mining Co.

Chamber of Deputies has approved the law-contract agreed upon last year between the Administration and the nitrate companies. On account of being a law-contract, its clauses cannot be altered without the consent of both parties. Passing of the bill seems now a certainty and will insure the investment of much needed capital in the nitrate industry to develop new and more efficient processes to win nitrate and other salts from the ores, such as the solar evaporation process that will enable Chilean producers to compete with synthetic nitrogen compounds under better conditions.

Administration has approved the conditions under which the South American Consolidated Enterprise will invest US $500,000 on the Mantos Blancos copper deposit, to the east of the port of Antofagasta. Mauricio Hochschild & Co., is behind this new enterprise and supplied the funds for drilling the deposit.

COLOMBIA

Fourteen different proposals for the granting of mining concessions for uranium and other radioactive minerals have been filed with Ministerio de Minas y Petroleos in consequence of the new legislation on radioactive minerals of Oct. 6, 1955. All the proposals refer to deposits located in the two Departments Santander and Norte de Santander in the northeast of Colombia.

CUBA

Minas de Matahambre's San Fernando mine is now shipping 23- to 25% copper concentrate and 56-58% zinc concentrate. A small concentrator is treating exploration and development ore at the property, according to Dr. Ernesto Romagosa, president of the mining company.

IN THE PHILIPPINES

Benguet Consolidated reports a marked improvement in operating profit for the nine months ending Sept. 30 as compared with last year. Bullion produced increased in value from $4,298,000 to $4,602,000. Operating profit was up to

A full line of BIRDSBORO HELPING HANDS for MINE AND QUARRY OPERATIONS

12″ x 20″
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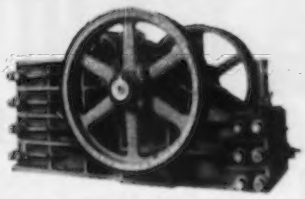

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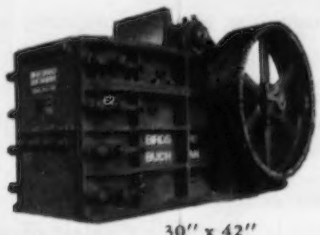

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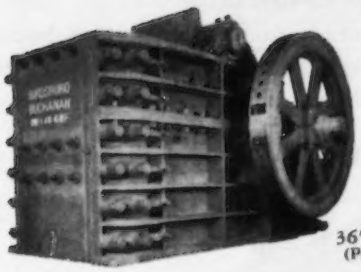
The deeper frame of Birdsboro-Buchanan crushers provides maximum closure to increase primary crushing reduction. The advance design components of the Birdsboro line, along with skillful engineering, result in more efficient performance for you. Call the Birdsboro man for details on the best size for your operation.



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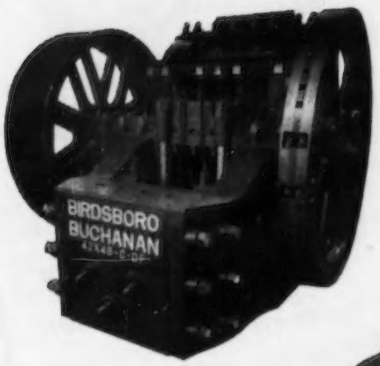

42″ x 48″
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48″ x 60″
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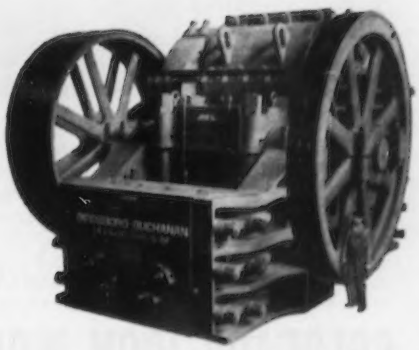

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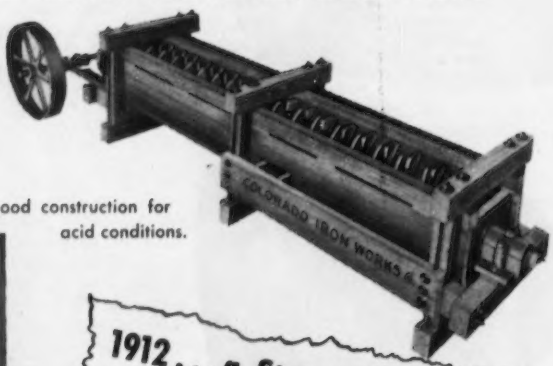
AKINS 1st in EXPERIENCE

on efficient, low-cost classification

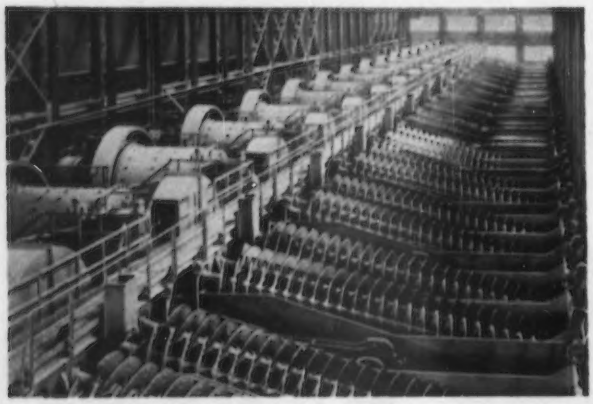
1908... the first Akins. Colorado Iron Works Company, established in 1860, specialized in making crushing, grinding, screening, cyanidation, amalgamation and smelting equipment. The Akins Classifier was developed by CIW to provide a practical, continuous system for separation of sand from slime.

The outstanding success of the Akins led to many other profitable applications and to Akins leadership in the field of classification. Today, every Akins installation on classification, sand washing, and heavy media is backed by 48 years of specialized classifier experience, 96 years experience in the mining machinery business.

1908... first Akins was for SHANNON COPPER CO., Clifton, Arizona



Photos show typical early models of the Akins, including one of wood construction for acid conditions.



1956 Photo shows part of present installation in large copper company operation... within a few miles of the same location where the first Akins was used by Shannon Copper Co. This company, since 1918, has used a total of 116 Akins Classifiers and 114 Marcy Mills in its various plants.

1912... a Statement of Policy ...Then as now

"Our aim has always been the production of a high-grade line of machinery, the prices being made as low as consistent with high quality. In no case do we attempt to build a machine to come within a certain price and place it in the field of competition with others having low first cost as their chief merit. It is this policy, consistently maintained for fifty years, that has established our enviable reputation."

(taken from CIW catalog No. 10C published in 1912)

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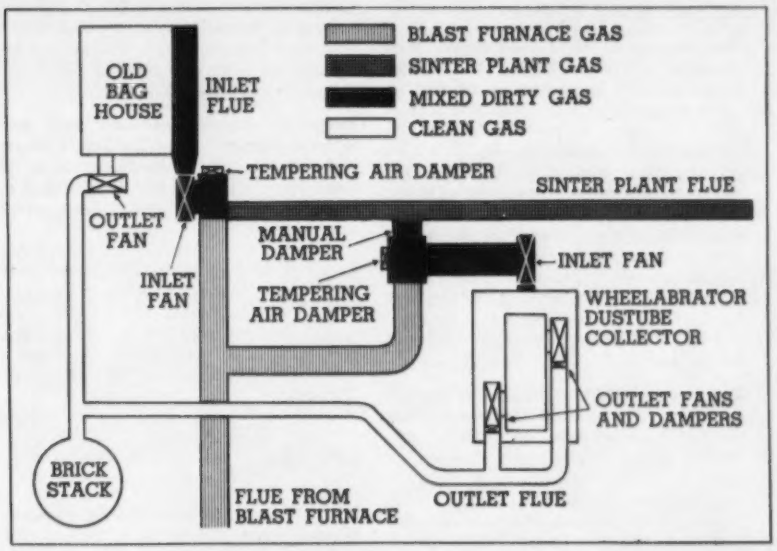
Write for Catalog 55C

SPECIALISTS IN CLASSIFICATION FOR 48 YEARS

DUST and FUME topics

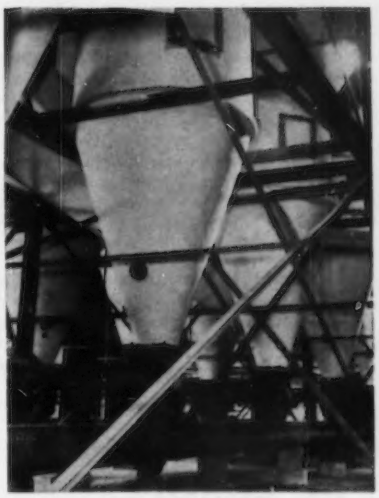
WHEELABRATOR CORPORATION Mishawaka, Indiana



NO AIR POLLUTION HERE! Dust and fume controlled at lead smelter

Expansion of sintering facilities and intake of lead at a prominent lead smelter necessitated additional smoke filtration facilities. After visiting other smelters and investigating various makes of dust collectors, plant officials selected a Wheelabrator Dustube Collector with Orlon fabric filter tubes.

As shown in the flow chart above, the Wheelabrator Collector filters flue gas from sintering machines and blast furnaces. In this continuous automatic installation the collected material is returned to the sintering plant where it is reused. Collecting efficiencies above 99% are uniformly obtained — cloth filtration is the oldest and most reliable method for removing solid contaminants from air or other gases.



Flexibility permits custom designing to fit the job

Wheelabrator Dustube Collectors can be designed to fit existing or new plant buildings, flue lines and ground contours. Various arrangements of hoppers and discharge mechanisms are available. They can provide continuous, severe service with a minimum of downtime and automatic units can be designed to permit interior inspection and maintenance without shutting down.

How to Save Money in the Metallurgical and Mining Industries

Wheelabrator Dustube dust collection systems provide an easy, low-cost way to salvage all the dust created in your operations. They permit you to recover valuable material, better working conditions and improve relations with the rest of your community. Investigate the details of design, operation and construction that bring all of these advantages to you. Send today for Bulletin No. 372-C.

No Downtime for Shaking or Dust Disposal

Gases from a sintering machine are effectively filtered at 25,000 cfm in this Wheelabrator collector at the New

Jersey Zinc Co., Empire Zinc Div., Colorado. Continuous and automatic, it controls dust without downtime for shaking or dust disposal.

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CORPORATION
(Formerly American Wheelabrator & Equipment Corp.)
438 S. Byrkit Street, Mishawaka, Indiana

This new handbook shows you

HOW and WHERE to prospect for atomic minerals

Here is practical help for getting in on the big boom in atomic minerals—a handbook of step-by-step guidance in prospecting for atomic ore deposits. Written with authority and easy to use. Tells how to look for and identify atomic ores, such as uranium, lithium, thorium . . . how to stake and develop a claim . . . how to evaluate and sell your minerals . . . everything from how to take an accurate mineral sample to map reading and preventing claim jumping.

Just Published!

PROSPECTING FOR ATOMIC MINERALS

Alvin W. Knoerr Chief Editor — **George P. Lutjen** Managing Editor

Engineering And Mining Journal

211 Pages, 5 x 7½, illustrated, $3.95

This handbook shows you where and how to look for atomic minerals by narrowing your search to specific rock types and formations. Quick-reference tables give physical and chemical tests for each mineral. You get practical help on travel, supplies and equipment, and others. How to detect radiation is thoroughly treated. Filing and protecting a claim, sampling, assaying, calculating size and value of deposit, etc., are covered. Tables and lists give government-guaranteed prices, smelters, and other aids. Each state's mining laws summarized in handy form.

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Philippines *(Continued)*

$931,000 from $872,000.

Balatoc Mining Company under Benguet management likewise had a larger bullion return in the same period, with $3,881,000 against $3,598,000 in 1954, and operating profit was twice as large, $777,000 against $370,000.

Ore reserves at the Toledo copper mine operated by Atlas Mining & Development Co. are estimated as of Oct. 1, 1955 at approximately 29-million tons of 1.03% copper and probable ore of 17-million tons of 0.96% copper, or a total of 46-million tons with the possibility that with additional exploration work the reserves might be raised to about 50-million tons by year-end. At the target rate of 10,000 tons milled per day this would provide sufficient ore for about 17 years operation. Present milling rate is about 4,150 tons per day. It is expected this rate will be stepped up to 6,000 tons by the year end.

Development work at Mindanao Mother Lode property in Zambales province has proven 120,000 tons of positive ore, grading about 3% copper. Estimate is based only on development work on a vein 500 ft in length and 20 ft wide. A concentrating mill of 400 tons capacity has been moved up from Surigao and is now being erected in its new location. It is expected to be in operation in March, 1956.

Elizalde Company has opened a new copper and iron deposit in Bagacay, 25 miles from Cathologam, Samor. Shipments are expected soon.

Base Metals Association reports that production of base metals in P.I. increased during the first nine months of the year to a value of 53.2-million pesos ($26.6-million), a gain of more than 6-million pesos over same period of 1954. Copper ore with a metal content of 12,542 metric tons of metal headed the list with a value of 20.6-million pesos, followed in order by iron ore (18-million pesos) and chromite (12.8-million pesos).

In October Lepanto Consolidated milled 38,145 tons of copper ore from which 4,937 tons of concentrates averaging 22.5% copper and 0.7 oz gold per ton were obtained. This was a new record for the mine.

IN EUROPE

BULGARIA

The Soviet Government has turned back to Bulgaria her share in the joint mining company "Gorubso," according to Sofia newspapers reaching Vienna. The papers said the agreement was signed in Sofia on Nov. 26. It provided for the repayment to the Soviet Union of the value of her share in the joint company "on favorable terms over a number of years."

The Gorubso joint Bulgarian-Russian mining company was responsible for the mining of brown and hard coal, copper, iron ore, lead, zinc, chrome, manganese and oil. It was the most important of all the joint Soviet-Bulgarian companies set up to exploit the natural wealth of Bulgaria after the war. Most of the other companies were sold back to Bulgaria in October 1954. It was believed that the mining of Bulgarian uranium ores, which was kept strictly secret, was carried on by another joint company of which the Russians still retained control.

Bulgaria's copper, processed until now in some country behind the Iron Curtain, is to be processed domestically in about three years, when the first Bulgarian copper-processing plant goes into actual production.

Construction work started during the first half of November 1955. The plant will process Bulgarian-mined copper ore; the combine not only will have fire refinery departments, but an electrolysis plant, and a manufacturing department where copper cables and profiles will be drawn.

WALES

ICI is to build, near its existing works at Waunarlwydd (Swansea) a factory for the fabrication of titanium, the company announces. Work will begin as soon as possible and it is hoped that the new factory, which will cost about £2-million will be in production in 1958.

Research and development work by ICI has culminated this year in the commissioning of two large-scale plants for the production of titanium and its alloys. The first of these, at Wilton in Yorkshire, is concerned with the extraction of metallic titanium and can produce 1,500 tons of granular titanium a year. The second, at the company's Kynoch Works in Birmingham, is responsible for melting granular titanium produced at Wilton, and forging it into slabs and bars for further fabrication.

Some fabrication into wrought forms —sheet, strip, plate, rod, tube and wire— is at present being carried out at the Kynoch Works and in other factories, including Landore and Waunarlwydd Works in South Wales. The demand for fabricated products (particularly sheet, rod and tube for the aircraft industry) is developing rapidly.

SWEDEN

State geologist Dr. Josef Eklund has announced the discovery of a 1-million ton alum shale-uranium orebody containing 0.03% U_3O_8. As reported in Geneva Roundup (October *E&MJ*), Swedish research has been directed toward alum shale for some time. It is not known how much of the million tons is commercial ore.

Swedish Atomic Energy Board has completed construction of its 5-ton per year uranium metal plant at Stockholm. U-235 extraction plant will be erected to produce atomic fuel from the metal.

Mack diesel dumper used to haul crushed stone and agricultural limestone from the quarry of the Waukesha Lime & Stone Co., Inc., Waukesha, Wis. In operation since 1905, this quarry is presently producing at a rate of 500,000 tons per year.

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For a work-speeding, profit-making combination, team up your big shovels with Mack trucks.

Macks keep shovels on the go because they make fast hauls between mine or quarry and unloading site. They can be depended upon to meet schedules because Macks don't bog down or break down when the going gets tough. They handle the heaviest loads under the toughest conditions. They require minimum maintenance and provide maximum fuel economy.

Whether you utilize trucks for removing overburden . . . for hauling ore from open pit mines . . . or in quarrying operations—putting Macks on the job will pay off because they make possible the most profitable use of machinery and manpower. Investigate Mack trucks today. Contact your nearby Mack representative.

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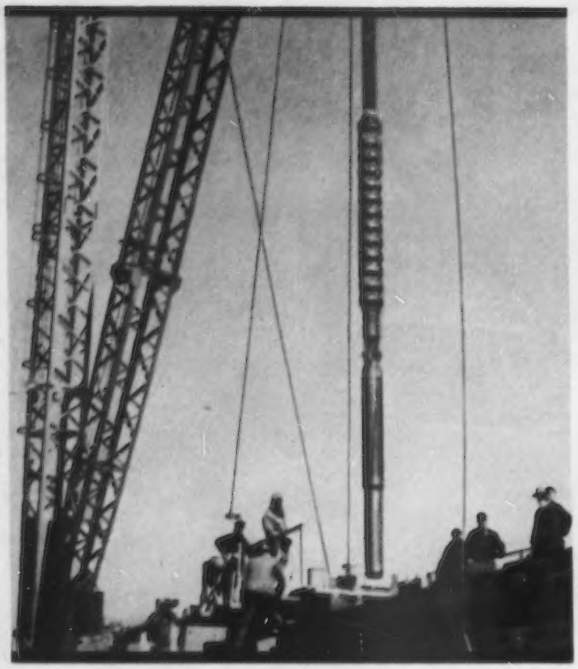

PROVIDES CORROSION PROTECTION FOR PUMPS IN WORLD'S LARGEST MINE DEWATERING PROJECT

PROBLEM: Calumet & Hecla Copper Co. was faced with the problem of pumping 7 billion gallons of water from the Osceloa Lode before mining operations could begin. Heavy concentrations of chlorides and explosive gases in the water ruled out pumps and discharge pipe of ordinary construction.

SOLUTION: Pumps and discharge pipes were lined by Calumet & Hecla personnel under field conditions at the mine site, with GACO N-200 Neoprene Liquid Lining, the heavy-duty, corrosion-resistant coating.

RESULT: GACO-lined pumps and pipes have successfully resisted corrosive mine water from March 1953 to date, eliminating need for costly replacement. Submersible pumps can be used at a greater mine depth than ever before.

MORAL: Heavy duty GACO N-200 is compounded specifically for lining your tanks, pipes, and equipment and to shield them from the combined attacks of chemical corrosion and abrasion. Under severe immersion service, where it is in direct and continuous contact with the corrosive agent, GACO N-200 provides unsurpassed protection. Because GACO N-200 is a liquid, it is especially valuable for protecting equipment having irregular surfaces, odd shapes, and perforated forms.

If you have an immersion or corrosion problem of any kind, contact the Gates Corrosion Clinic. There's a GACO Corrosion Specialist in your area prepared to serve you.

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PNEUMATIC GROUTER and "PEA SHOOTER"

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For complete details and specifications, write for Free Bulletin 13

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AWFCO A. W. FAHRENWALD CO. E. 3500 RIV., SPOKANE, WASH. PRODUCTS OF RESEARCH

Do you save money when you by-pass your distributor?

See Page No. 175

Prospecting. The 'Jeep' Truck is a workhorse for towing equipment over rough areas. With the extra traction of its 4-wheel drive, it reaches off-road areas where there's work to be done. Its partner, the Universal 'Jeep' is equally adaptable for prospecting needs.

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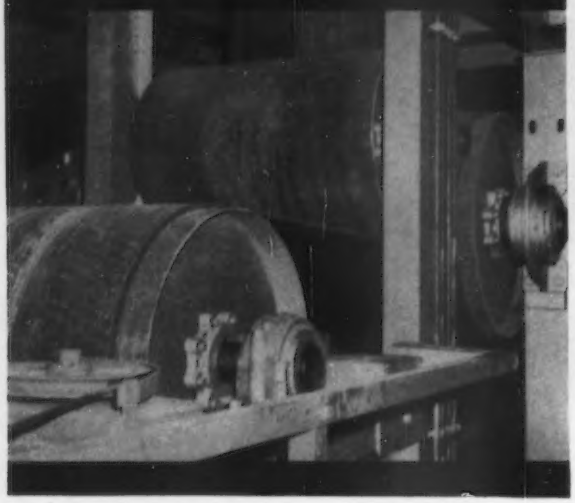

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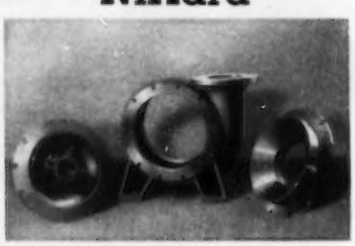

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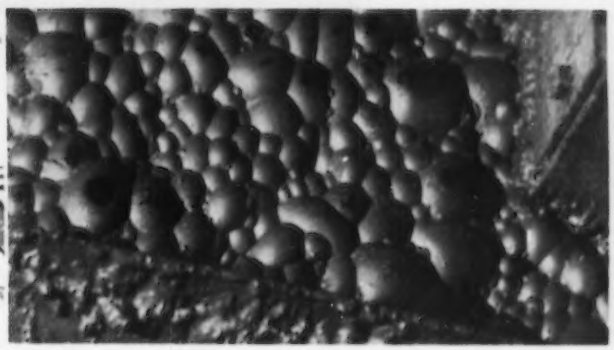

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P-8425—Engineering and Mining Journal
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Please send complete resume, including details of education and experience, to:

Mr. J. C. Costello, Jr.
Personnel Relations Section
Engineering Department

E. I. du Pont de Nemours & Co., Inc.
Wilmington 98, Delaware

PROJECT ENGINEER WANTED

Graduate Mining, Metallurgical, Chemical or Mechanical Engineer, preferably 25 to 35 years old, wanted by medium size progressive heavy machinery manufacturing company located in Southeastern Pennsylvania. To assist in design and preparing for market of various lines of equipment used in mineral dressing, heavy chemical, cement and rock products industries. Must have had engineering and field experience, and be willing to work on drafting board, travel and do field service. Opportunity also exists for a properly qualified individual, eventually to become a sales engineer. Salary open.

P-7533 Engineering & Mining Journal
330 W. 42nd St., New York 36, N. Y.

ASSISTANT CHIEF ENGINEER

Age limit 45. Must be graduate mechanical, chemical or civil engineer with natural mechanical ability, excellent practical and supervisory and some construction experience, for charge under Chief Engineer of all shops, foundry, mobile equipment including loading, marine, railway and construction; maintenance and repair of all types of equipment; 7200 KVA diesel generating plant. Mine and mill 2600 tons/day. Flotation Mill Copper. Salary open. Foreign. With initial letter send full experience, references, age, marital status, number and age of children. Reply: Cyprus Mines Corporation, Suite 1206, 523 West Sixth Street, Los Angeles 14, California.

CHIEF GEOLOGIST—MINERALS

15 to 25 years experience in field exploration and mine examination. Must be competent negotiator; have ability to handle people and substantial experience in economic analysis and evaluation. Excellent opportunity to take charge of exploration department for successful domestic mining company and become member of management team. Oil and gas geological experience also desirable. Salary open. Send detailed resume. Confidential.

P-7866 Engineering & Mining Journal
330 W. 42 St., New York 36, N.Y.

Smelter Superintendent

Required for 5,500 K.V.A. electric copper smelter in Uganda, British East Africa.

Applicants should be fully experienced in copper smelter operation consisting of electric furnace, converters, etc.

Three years contract offered with married accommodation, passages, and generally good working conditions and allowances. Salary according to qualifications.

Apply with fullest details as to experience, references, personal data etc. to

General Manager
Kilembe Mines, Ltd.
P. O. Kilembe
Uganda, British East Africa

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An employment advertisement in this EMPLOYMENT OPPORTUNITIES section will help you find the engineers you need. It's an inexpensive, time saving method of selecting competent personnel for every engineering job in the Mining industry. The selective circulation of ENGINEERING & MINING JOURNAL offers you an opportunity to choose the best qualified men available.

WANTED

CHIEF ENGINEER,

To take charge of their general engineering department, and to be responsible to the Managing Director. Applicants should have had wide mechanical and electrical engineering experience; experience in mining, fuel utilization and power generation would be an advantage.

The job will be based on London, but will involve periodic short visits overseas. Admission to Pension Scheme. Applications, which will be treated in confidence, should include particulars of age, qualifications, experience, and salary required, and should be addressed in writing to the:

Managing Director
POWELL DUFFRYN TECHNICAL SERVICES LIMITED
19 Berkeley Street
London, W.1., England

COAL PREPARATION ENGINEERS WANTED

Must be well versed in design and layout of complete bituminous coal preparation facilities and all phases of cleaning, such as screening, mechanical dewatering, thermal drying and the various methods of coarse and fine coal preparation. Applicants must be of administrative caliber and capable of guiding the work from proposal stage to actual plant design. Location, eastern Pennsylvania. State acceptable starting salary and furnish resume of education and experience.

P8717 Eng. & Mining Journal
330 W. 42 St., New York 36, N.Y.

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(1) 350 HP Vulcan Single Drum
1000 FPM
25000 # Rope Pull
Will wind 850' of 1½" rope in one layer
Air Brake
Post Brake
Indicator
Overspeed and overwind devices
Herringbone gear
Dynamic braking
Rope capacity approx. 2500' of 1½" rope
350 HP West. motor, 3/60/2200, complete with controls.

(2) Flory Double Drum
Duty 9500 # @ 250 FPM
Total load on drum, 18,500#
(2) drums 6' dia. x 5'6" face, grooved 1½"
(1) drum clutched
Dead weight brake
Overspeed and overwind devices
Indicator
Post brakes
Motor and control will be furnished to meet customers requirements.

BERRETTINI ELECTRIC CO.
380 N. MAIN ST., PLAINS, PA.

2 Barrett Haentjens Acid Resisting Pumps,
1 Stainless Steel, 1 Bronze
300 GPM 575 Ft. Head Direct Connected on a common cast iron base to 75 HP 3 phase, 60 cycle, 440 Volt, 1800 RPM KT motors.
Price $1000 Each
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2—30" x 54", 3' x 8', 4' x 9', 4' x 11', 4' x 14", 5' x 10', 5' x 14', 6' x 12'

HARDINGE CONICAL BALL MILLS
6' x 14", 6' x 22", 6' x 36", 7' x 22", 7' x 36", 8' x 18", 10' x 48"

BALL MILLS
3' x 4', 5' x 8', 5' x 10', 6' x 8', 6' x 9', 6' x 10', 7' x 5', 7' x 6' #86

FLOTATION CELLS
12—Type ES Kraut Cells
1—#500 and—#750 Denver Unit Cells

DRUM FILTERS
3' x 6', 8' x 10', 12' x 14', 11'6" x 18' Oliver
12' x 10', 2—14' x 18' Dorrco Drum

CLASSIFIERS
1—3' x 24' x 12' & 1—4'6" x 26' x 16' Wemco Bowl
1—3' x 24'10" x 10' Dorr Turrett Bowl
8 x 34 & 8 x 23 Rake
48" x 27' —3 Wemco Densifier
4' x 22' Dorr Rake
36" x 25' Eagle Screw

THICKENERS
WEMCO 10' x 8', 14' x 12', 20' x 12'
DORR 14', 16', 20', 24', 26', 36', 80' & 100'

LARGE JAW CRUSHERS
48 x 60, 42 x 48, & 30 x 42

ROTARY KILNS
5' x 60', 6' x 28', 8' x 80', 9' x 125'

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CHICAGO: 520 N. Michigan Ave. (11)
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200 to 300 KW AC
220/440 V 3 Ph. 60 Cy.
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Must be A1 Condition and Bargain
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BLOWERS
1—Jeff. Universal type mine ventilator with 5 HP motor
1—Size #3 Roots-Connersville
1—Jeff. 11½ intake, 9½ disch. with 2 HP Ind. motor
1—Joy axivane, series 1-21 with 5 HP motor
1—Coppus Ventair, TM-6
1—Coppus Vano SP-175, new 12" beaded diffuser
1—American Sirocco, 3-P
1—Victor Acme positive displacement, size 24

BITS
Portland Throwaways—1-9/16", 1-5/8", 1-11/16", 1-7/8", 2"
Liddicoat 2H and 2L—1 1/2", 1-9/16", 1-5/8", 1-11/16", 1-3/4", 1-13/16", 1-7/8", 1-15/16"

AMALGAMATION BARREL
1—Joshua Hendy 18" dia. x 24" long with ¾ HP Master Gearmotor, 48 rpm, 220/440 v.

CARS, MINE
19—Ajax Coeur d'Alene 32 cu. ft. 18" ga., side dump
57—14 cu. ft. 18" ga. swivel end dump type
8—18.8 cu. ft. mine cars, end dump
6—20 cu. ft. swivel type end, 18" gauge, roller bearing
1—14 cu. ft. mine car, roller bearings, 20" ga. timber truck

CLASSIFIERS, RAKE
1—6' x 25' Dorr Duplex
1—4'6" x 18' Duplex reciprocating rake
1—6' x 19'6" type 6, Dorr duplex rake
1—6' x 23'6" Dorr Model DSD Duplex Rake
11—6' x 27' Dorr Duplex rake
1—6' x 20' Eimco Duplex rake
1—8' x 26' Denver Duplex rake
1—6' x 26'8" Dorr Duplex rake Model DSFH
1—24' x 16' Denver Crossflow

CLASSIFIERS, SPIRAL
1—48" x 18' Spiral (Akins type)
1—24" x 10' Spiral, Simplex, double pitch

CLASSIFIERS, BOWL
2—6' x 26'8" x 12 dia., Dorr Model DSFB

CONVEYORS
1—36" x 121' Centers, bridge type steel frame
1—20" x 54' antifriction centers
1—18" x 32' centers
1—18" x 25' centers, steel frame
1—18" x 25' centers
1—16" x 24' centers
1—30" x 21' centers
1—16" x 12' centers, steel frame

CRUSHERS
1—28 x 36 Traylor Blake Type
1—10 x 21 Telsmith roller bearing
1—9 x 16 Eimco
1—8 x 15 Tuttle Mfg. Supply
1—8 x 12 Risdon Blake
1—8 x 10 Denver Eng. Co.
1—3' Symons shorthead
1—2' Std. Symons with coarse bowl
1—1'8" Reduction Traylor Type TY

DUST COLLECTOR SYSTEM
1—Roto-clone with 15 HP American blower

ELEVATORS
1—Belt, bucket 25' centers, 8" by 5½ buckets

FEEDERS
4—30" x 5 S.A. Apron type
1—Ore 18" x 7'6" reciprocating plate
1—Lime, eccentric type with storage bin
1—Grizzley, small steel frame 24" x 30" x 1¾"

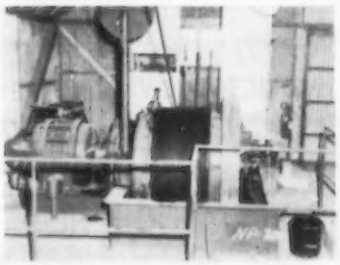
FILTERS
1—8' x 6' Portland drum
1—8' x 4' Oliver drum
1—4' 2-leaf Eimco
1—4' single-leaf Eimco
1—4' 4-leaf American
2—6' 2-leaf American

FLOTATION UNITS
1—#24 4-cell Denver rougher
1—#18 2-cell Denver Sub A
1—#18 3-cell Denver Sub A

MOTOR GENERATOR SET
2—50 KW D.C. Allis Chalmers 250 v. with 75 HP West. Ind. Motor

DIESEL GENERATOR PLANTS
1—300 KW 450 volt, 3 phase, 60 cy. GM8, 268A Eng.
1—220 KW 440 volt, 3 phase 60 cy. with two Model D-13,000 Cat. Eng.
2—112½ KVA skid mounted, 220/440 volt, D-17,000 Eng.
2—50 KW 240 volt, AC with International Model UD-18, full

HOISTS, SHAFT



1—100 HP Single Drum Taylor Fdry and Eng.
1—Vulcan 125 HP Single drum
1—Vulcan 150 HP Single Drum
1—Ottumwa 225 HP single drum
1—Coeur d'Alene Hardware 400 HP double drum, like new
1—Ottumwa 600 HP Single Drum

HOISTS, SLUSHER AND TUGGER
2—25NNN3D I. R. Electric three-drum
4—HEE G. D. air two-drum
1—7NNIJ Electric, two-drum
1—S211 Joy air, two-drum
2—20NM2D I. R. Electric, two-drum
1—CF211 60 HP Sullivan, two-drum
4—HK G. D. Single-drum
2—HA-3 Sullivan, single drum
3—E112 Sullivan, single drum
2—EUA I. R. single-drum

JIGS, MINERAL
1—8 x 12 Denver Simplex
1—12 x 18 Denver Duplex

LOCOMOTIVES, BATTERY
4—Locomotives, Mancha-Titan AN 18-24" gauge, 3½ ton
1—3 ton Greenburg 24" gauge
2—Mancha "Little Trammers"
1—Whitcomb 3½ ton 24" gauge
1—5 ton trolley locomotive, Goodman 42" gauge

MILLS, BALL AND ROD
23—Marcy 86 (8x6)
4—Marcy 96 (9x6)
3—8 x 36 Hardinge ball
1—7 x 36 Hardinge ball
1—6 x 6 Hendy
1—6 x 4½ Marcy
1—6 x 22 Hardinge
1—6 x 16 Hardinge
1—5 x 5 Marcy
2—5 x 14 Allis Chalmers ball
4—5 x 14 Marcy ball
5—5 x 10 Allis Chalmers rod
1—5 x 5 Marcy ball
1—4½ x 16 Hardinge
1—4 x 4 Marcy

MUCKERS
4—GD-9 Gardner Denver 18" ga. rebuilt

PULVERIZERS
1—Braun UA Lab.
1—Ller 6" Lab. with motor

PUMPS, SAND
3—2" (new) Allen Sherman Hoff Hydroseal type A
1—4" Allen Sherman Hoff Hydroseal, vertical
3—1½ Denver
1—Kimball Krogh, 1½"

SCREENS
2—2' x 4' Selectro single-deck vibrating with 1½ HP motor

SIEVE SHAKER
1—Braun sand for 8" dia. sieves
1—Tyler Ro-Tap

THICKENERS
3—40' x 10' Eimco mechanisms
2—20' x 8' Dorr, with wood tanks
1—12' x 8' Denver, with wood tank
1—10 x 6 with steel tank

WEIGHTOMETER
1—Merrick Model E for 18" conveyor

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All Sizes
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250 Volt, 2 amp. ..... $20. ea.
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100—"Wolf" #100 ..... $5. ea.
Phila. Transformer Co., Box 506, Dalton, Pa.

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—YOUR BEST SOURCE—
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Ing. Rand Centrifugal Pump, #10-ALV, 3000 GPM—200'. UNUSED.
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Mining Machinery, Heavy Equipment, Trucks, Electrical Equipment, Laboratory Equipment, Office Furniture and Machines and Quonset Buildings.

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We have been commissioned by Special Master, Mr. E. L. McHaney, Jr., acting for the United States District Court, Eastern District of Arkansas, Northern Division, to sell at public auction the holdings of the Westmoreland Manganese Corporation.

Tuesday and Wednesday, February 7 and 8, 1956 — 10:30 A.M. (CST) 1st. Day
Continuing until sold. — 10:00 A.M. Thereafter.

All equipment is in like new condition, some of it never having been used since the mine was never put into operation. All equipment has been purchased since 1952 and is in excellent condition.

The sale will be conducted in the main office building of the corporation, approximately 4½ miles northeast of Cushman, Arkansas.

A List of Equipment as Follows:

MOTORIZED EQUIPMENT: Acquisition cost in excess of $875,000.00. Included in this list are 10 Euclid 15 yd. Rear Dumps; 3 Caterpillar Tractors; 1 Bucyrus-Erie Scraper; 1 Marion Type 111-M Dragline; 4 Manitowoc Dragline, Mdl. 4500; 2 Manitowocs, Mdl. 3500; Trucks: Pickups; Cars; Tournadozer and other items too numerous to mention.

MACHINERY & VALVES: Acquisition Cost in Excess of $325,000.00. This list includes Scalpers, Crushers, Screens, Washers, Strainers, Separators, Pumps, Thickeners, Valves, etc. All in new condition.

PUMP HOUSE: Acquisition Cost in Excess of $15,000.00. Ingersoll-Rand Pumps, Pipe Fittings, Structural Steel and hundreds of misc. items.

WASHER BUILDING: Acquisition Cost in Excess of $125,000.00. 9—24" & 36" Conveyors totaling about 1260'; Hoppers, 252' of 9' Corrugated Culvert, Vibrators, Pipe, Structural Steel, Tanks and Etc.

WAREHOUSE: Acquisition Cost in Excess of $15,000.00. Wire Rope, Tires, Lubricants, Tools, Shovels, Bolts and Nuts, Pipe and Fittings, Welding Electrodes, Machinery Parts, Fire Extinguishers and hundreds of other items.

CHEMISTRY LAB: Acquisition Cost in Excess of $6,000.00. This is a complete laboratory set-up with all accessories and supplies.

OLD WAREHOUSE: Acquisition Cost in Excess of $16,000.00. Sample Grinders, Crushers, Belts, Nuts, Roller Chain, Valves, Pump Parts, Etc.

MAINTENANCE SHOP: Acquisition Cost in Excess of $7,500.00. Machinery parts and accessories, Drag Buckets, Scraper Blades, Pipe, Angle Iron & many other items.

OLD WAREHOUSE AREA: Acquisition Cost in Excess of $40,000.00. Churn Drill Tools, Bbls. of Oil, Corrugated Roofing, Dozer Blades, Lumber, Power Poles, Dynamite, Etc.

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SHOP EQUIPMENT: Acquisition Cost in Excess of $32,000.00. Large Selection of power and hand tools, Welders, Presses, Jacks, Chains, Boomers, Oils, Greases, Etc.

ENGINEERING DEPARTMENT: Acquisition Cost in Excess of $2,000.00. Transits, Levels, Drafting Machines, and Accessories.

CAFETERIA EQUIPMENT: Acquisition Cost in Excess of $7,500.00. Complete Cafeteria.

OFFICE FURNITURE & MACHINES: Acquisition Cost in Excess of $30,000.00. Office furniture, Calculators, Adding Machines, Typewriters, File Cabinets and Office Supplies.

HEATING & COOLING EQUIPMENT: Air Conditioner, York; 5 Janitrol Heaters; Water Coolers; Radiant Heaters, Etc.

REAL ESTATE: Approximately 5,000 acres of land, located in Independence and Izard Counties, Arkansas. For further information on the real estate, contact the Special Master, Mr. E. L. McHaney, Jr., Pyramid Life Building, Little Rock, Arkansas. Telephone FR 4-5051.

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LOCOMOTIVES: 2—American Locomotive Co. 1000 H.P., 115 ton, G.E. electric equipment. Sale or rent.

REDUCTION CRUSHER: Allis Chalmers R548 Hydrocone, with large stock new parts, condition like new.

JAW CRUSHERS: Allis Chalmers 18 x 30 sectionalized for underground use. V-belt, 50 H.P., 220/440 volt motor, new condition. Also, 48 x 60, 42 x 40, 36 x 48", with or without motors and drives. Other sizes from 4 x 6 to 48 x 60".

DRYERS: 2—Ruggles Coles XA18, 104" x 70 ft., double shell, with 60 H.P. motor, speed reducer, exhauster, etc., suitable for use as kilns. Available 90 days. Condition like new.
1—5' x 30 ft. complete with all auxiliary equipment.

SCREENS: Tyrock 5' x 12', single deck, type F600. Allis Chalmers 4' x 12', single deck, low head.

BALL & ROD MILLS with 100 H.P. to 500 H.P. motors.

OVERHEAD ELECTRIC CRANES: 1—10 ton, 54' span, 4 motor, bucket operating, 440 volt, AC, cab control. Other cranes A.C. and D.C., 5 ton to 150 ton.

LOCOMOTIVE CRANE: 25 ton capacity, standard gauge, gasoline powered, cast steel trucks, air brakes, with or without 1½ yd. Williams clam shell cated Minnesota. For sale or rent.
bucket, thoroughly modern, excellent condition. Lo-

MINE HOIST SPECIAL: Vulcan 650 H.P., double drums, 8' dia., 7'6" face, one drum clutched, 1¼" rope, 1400 FPM, thoroughly modern, with control and safety devices.

MINE HOISTS: Single and double drum, 100 to 2500 H.P., with all electrical equipment. Complete specifications, drawings, photos, available.

HOIST MOTORS:
300 H.P., 435 RPM. — 600 H.P., 710 RPM.
400 H.P., 588 RPM — 1200 H.P., 444 RPM.
2200 volt, A.C. with controls.

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Serial #8001. 250 H.P. 2300 volt slip ring motor drive Hoist designed for 350 f.p.m. of 1 7/8" rope. Face of drum 55 9/16", diameter to bottom of groves, 84" Electric brake connected. Split drum, all steel base, Blue prints available.

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1 Link Belt dble. deck concentric action vibrating screen size CA2410, used 3 weeks, price $1600

1 Barber Green Conveyor, mod. 38-4-15. Crawler mounted. 4 cyl. Buda 31" belt will load tractor trailers, excel. cond. $2100.

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330 W. 42nd St., New York 36, N. Y.

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1—3½ ton Atlas, 24" gauge
1—4 ton Westinghouse, 24" gauge
1—4 ton Ironton, 36" gauge
2—6 ton General Electric
1—6 ton Mancha Trackmaster, 24" gauge
2—7 ton General Electric, 36" gauge, permissible
1—7 ton Atlas, 36"-48" gauge
2—8 ton General Electric, 36" gauge
2—8 ton Goodman, 36" gauge
3—8 ton Ironton, 24"-48" gauge
4—10 ton Atlas, 36" gauge

TROLLEY LOCOMOTIVES

1—4½ ton Goodman, 36" gauge
1—5 ton Jeffrey, 36" gauge
2—5 ton Jeffrey, 42" gauge
1—6 ton Goodman, 36" gauge
1—6 ton Goodman, 42" gauge
2—8 ton Goodman, 42" gauge
3—10 ton Jeffrey, 42" gauge
1—13 ton Goodman, 42" gauge
1—13 ton Jeffrey, 42" gauge
3—15 ton Jeffrey, 42" gauge

FILTERS

2—2' x 4' Morse drum filters
2—4' x 8' Eimco drum filter
1—6' x 3' disc American leaf filter
1—18" Morse round pattern filter press
1—36" Merrill triangular filter press
1—#12 Sweetland filter press

SLUSHER HOISTS

1—Joy 15 h.p. double drum slusher Model AF-212
1—Joy 15 h.p. double drum slusher Model AAF-212
1—Joy 10 h.p. 3 drum slusher
1—Sullivan 2 drum slusher Model HD-10-B, gas engine driven

HOISTS

1—10 HP Vulcan #0 Single Drum
1—15 HP Box Single Drum
1—20 HP H&B Single Drum
1—22 HP Vulcan Single Drum #1½
1—30 HP Vulcan Double Drum
1—30 HP Vulcan Single Drum
1—37 HP Single Drum
2—52 HP Vulcan #4½ Single Drum
1—50 HP Fairbanks-Morse Single Drum
1—60 HP Vulcan #23ELF Single Drum
4—100 HP Box Single Drum
1—112 HP Vulcan Single Drum
3—125 HP Ottumwa Single Drum Hoists
2—150 HP Vulcan Single Drum
1—250 HP Ottumwa Single Drum
1—375 HP Dillon-Box Single Drum
1—22 HP Vulcan #1½ Double Drum
1—15 HP Stine Single Drum Contractors' Type
1—25 HP Domestic Two Drum Contractors' Type
1—40 HP Thomas Single Drum Contractors' Type
1—40 HP American 3 Drum
1—60 HP Thomas 3 Drum
1—60 HP Lidgerwood
1—60 HP Clyde 3 Drum

CRUSHERS

4—2¼" x 3½" New Morse Lab Jaw Crushers
4—4" x 6" New Morse Lab Jaw Crushers
1—9" x 15" Farrell Jaw Crusher
1—8" x 24" Rodgers Jaw Crusher
2—11" x 18" Universal Jaw Crushers
1—24" x 13" Farrell Jaw Crusher
1—10" x 16" Hercules Jaw Crusher
1—15" x 24" Universal Jaw Crusher
1—26" x 18" Williams Hammermill

COMPRESSORS

1—44 CFM Ingersoll-Rand
2—88 CFM Ingersoll-Rand
1—179 CFM Ingersoll-Rand
1—360 CFM Gardner-Denver, model WBH, with 75 HP motor
1—447 CFM Ingersoll-Rand
1—637 CFM Sullivan
1—698 CFM Union
1—800 CFM Ingersoll-Rand
1—1418 CFM Ingersoll-Rand

PORTABLE COMPRESSORS

1—105 CFM Ingersoll-Rand, gas engine driven
1—105 CFM Worthington, gas engine driven
1—125 CFM Jaeger, gas engine driven
1—210 CFM Worthington, continental gas engine
1—230 CFM Gardner-Denver stationary, Buda gas engine
1—310 CFM Sullivan, Buda gas engine
1—310 CFM Gardner-Denver stationary, Buda gas engine

BALL AND ROD MILLS

1—4' x 4' Marcy Ball Mill
1—6' x 48" Hardinge Conical Ball Mill
1—8' x 22" Hardinge Conical Pebble Mill
1—3' x 8' Marcy Rod Mill

VENT PIPE

3300 ft.—16" galv. steel vent pipe, 16 ga.
1400 ft.—18" steel vent pipe, 12 ga.
3200 ft.—20" steel vent pipe, 14 ga.

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CRUSHERS

1—48"x60", 42"x48", 36"x42", 30"x36", 24"x36", 18"x36", 12"x24" Jaw Crushers
2—42" x 16" Allis-Chalmers Crushing Rolls 36"x16" rebuilt Sturtevant rolls
2—24" x 14" Rogers Iron Works Rolls
1—24" x 12" Farrell Bacon Crushing Rolls
1—No. 322 Allis-Chalmers Hydrocone Crusher 48" Telesmith Gyrosphere Crusher—28" Telesmith Intercone Crusher
1—6", 10", 16" and 20" McCully Superior Gyratory Crushers
No. 3 up to No. 12 Gyratory Crushers

BALL, ROD & TUBE MILLS

1—6' x 12',5½' x 10', 8' x 6' Ball Mills
2—5' x 16'; 1—½' x 10', 6' x 12' Rod Mills
2—5½' x 20' Tube Mills
2—6' x 22' Combel Mills—6' x 22' Tube Mills
1—8' x 36" Hardinge Mill
3—3-Roll Bradley Hercules Mills, Direct Connected to 300 HP Motors

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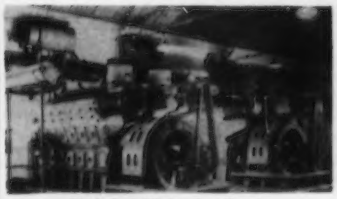

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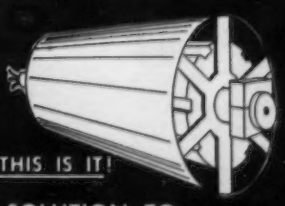

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